"Tran, Jeanne (ECY)"
<JTRA461@ECY.WA.GOV>
06/19/2009 04:25 PM

To Susan Poulsom/R10/USEPA/US@EPA
cc
bcc
Subject FW: Reasonable Technology - AKART-

Susan, I drafted a response to Eric's questions (see below). I want to check with you to see if you have problems with Ecology calling the following values as AKART-based limitations for drydock floor discharge:

average copper concentration of 24 ug/L, and
95th percentile concentration of 53 ug/L.

Please let me know ASAP, before I send it to Eric. Thanks, Jeanne

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Eric,

I am sorry for taking so long to respond back to you. I have had too many irons in the fire during the last couple weeks. Here is my response to your questions.

Please note that Ecology is not endorsing electro-coagulation treatment. The facility is responsible to find a treatment system that is effective and appropriate to treat their own wastewater, when the implemented best management practices (BMPs) or source control are not adequate to reduce the pollution to meet water quality standards. Nichols Brothers has chosen the electro-coagulation treatment technology to treat their wastewater. Nichols Brothers is the only facility discharges to surface water, for which we have adequate data to show the effluent quality that can be achieved after treatment.

Even if I include the data that Nichols Brothers (generated during the shakedown period, the average copper concentration is about 24 ug/L, and the 95th percentile is 53 ug/L (using a total of 18 data points). If we don't count the shakedown period (May 07 to August 07), the average copper concentration would be 16 ug/L and the 95th percentile would be 31 ug/L.

According to the Navy's data that you sent me, at an 8 NTU cutoff, the average copper concentration is 43 ug/L, and the 95th percentile is 110 ug/L.

Given the limited data (18 data points) generated from the Nichols Brothers, the state will accept an average copper concentration of 24 ug/L, and a 95th percentile concentration of 53 ug/L as AKART values for drydock floor effluent.

If the Navy believes that the Oily Water Treatment System (OWTS) has the capability to treat the floor drainage water to Nichols Brothers' range or better, the State will not object to the proposed treatment system.

Cost: unfortunately, the cost for constructing any type of wastewater treatment systems is not cheap these days. According to Todd Pacific Shipyards, they have spent about 10 million dollars for their stormwater collection system so that they could route their contaminated stormwater to the King County Wastewater Treatment System in 2003. I am sure

Nichols Brothers has spent a fair amount to build their electro-coagulation wastewater treatment system as well. I don't have a number to share with you at this point.
The Washington Department of Ecology-Water Quality Program has a mission to prevent pollution and enhance the quality of our water resources. In order to achieve this, our job is to implement the state and federal laws and regulations. Chapter 173-201A-400(2) WAC requires the discharger to fully apply AKART prior to being authorized a mixing zone. For definition of AKART, please refer to the Department of Ecology Permit Writer's Manual, Chapter IV.

Other shipyards (Nichols Brothers and Pacific Fishermen) have implemented all the necessary pollution prevention measures as required in their permit and still have to employ treatment technology to reduce the amount of pollution in their stormwater further, in order to bring their effluent quality closer to meeting the water quality standards. The Navy should have the same responsibility to do the same, if not better, especially given the fact that PSNS is the largest active shipyard in the state. As Kevin Fitzpatrick mentioned in our last meeting, if time is an issue, the state could grant a compliance schedule for the Navy to achieve the AKART-based limitations. In accordance with Chapter 173-201A-510(4)(c), the maximum allowable period of a compliance schedule is 10 years (not 12 years as mentioned by Kevin).

I hope I have answered your questions. Bruce Beckwith and Jerry Sherrell know quite a bit about Water Quality Laws and Regulations, and they could provide you a lot of insights as well. If I can help you with anything else, please don't hesitate to contact me.

Jeanne Tran, P. E.
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Bellevue, WA 98008-5452
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-----Original Message-----
From: Harrison, Eric J CIV PSNS, 106.32
[mailto:eric.j.harrison@navy.mil]
Sent: Thursday, June 04, 2009 1:59 PM
To: Tran, Jeanne (ECY)
Cc: Poulsom.Susan@epamail.epa.gov; Kelly, Wendy M CIV PSNS/IMF, Code 107
Subject: Reasonable Technology - AKART-

Hi Jeanne,
It was nice to finally meet today in person.

I am new so I am unsure if my confusion has been addressed in previous conversations. The confusion I have is that electrocoagulation data has a higher average effluent concentration than our PWCS; electrocoagulation shows an average copper effluent of 46 ppb compared to 43 ppb for our PWCS. I believe you are looking at just one set of 12 samples from Nichols Brothers. The data that was in Bruce's AKART response is what I gave you today and is electrocoagulation data from Pacific Coast Shredder, Nichols Brothers, and Exterior Wood from 2007-2008. I don't think it is reasonable to select the best data set and say this is AKART. Our PWCS data has over 1,000 data points and I don't think it would be fair to select our best 12 samples and say this

is the new AKART standard either. Nor do I think it is fair to throw out high outliers because our PWCS also has high outliers that would need to be thrown out.

My perspective might be skewed (I lived off of $5/day in Honduras with the Peace Corps), but for me, spending over $21 million dollars (and that's not including the cost of the actual treatment plants) on technology that has not yet been proven effective in treating below our average copper effluent is unreasonable and therefore falls outside of the definition of AKART. I believe that with our current pollution prevention measures and an average 43 ppb copper effluent we are achieving AKART and the discussion of a mixing zone should be the next step in our discussions.

Thank you again for coming all the way out to Bremerton to see our facility. I hope the tour was informative and I look forward to working with you in the future.

Eric Harrison
C/106.32 NPDES Water Program Manager
Puget Sound Naval Shipyard
Tel. 360 476 4738


why pwcs exceeds AKART.doc


response to AKART questions.pdf

Dry Dock Stormwater: The PWCS in combination with source control and good housekeeping meets or exceeds AKART.

The ability of the PWCS to detect and divert contaminated stormwater compares favorably with other available treatment systems to manage dry dock stormwater. For comparison, electro-coagulation system data provided by WDOE has a higher average copper treated effluent concentration, higher 95% concentration and higher max concentration than the PWCS.

	PWCS Cu (ppb) (8 NTU Set point)	Electro-coagulation Cu (ppb)
Median Effluent	33	12.5
Average Effluent	43	46
95% Effluent	100	152
Max. Effluent	190	666

	PWCS Zn (ppb) (8 NTU Set point)	Electro-coagulation Zn (ppb)
Median Effluent	190	190
Average Effluent	209	938
95% Effluent	478	5,300
Max. Effluent	1000	12,700

Electrocoagulation VS Process Water Control System

Electrocoagulation		PWCS	
Data Location:	Cu Effluent (ppb)	Turbidity	Cu Effluent (ppb)
Pacific Coast Shredder Data	3	0.27	22
Pacific Coast Shredder Data	5	0.29	24
Pacific Coast Shredder Data	2	0.30	23
Pacific Coast Shredder Data	2	0.30	21
Pacific Coast Shredder Data	13	0.31	21
Pacific Coast Shredder Data	6	0.31	21
Pacific Coast Shredder Data	4	0.31	23
Pacific Coast Shredder Data	3	0.32	23
Pacific Coast Shredder Data	2	0.32	23
Pacific Coast Shredder Data	19	0.32	22
Pacific Coast Shredder Data	12	0.33	20
Pacific Coast Shredder Data	47	0.34	21
Pacific Coast Shredder Data	51	0.34	26
Pacific Coast Shredder Data	30	0.34	21
Pacific Coast Shredder Data	34	0.34	23
Pacific Coast Shredder Data	161	0.34	21
Pacific Coast Shredder Data	46	0.34	23
Pacific Coast Shredder Data	14	0.35	23
Pacific Coast Shredder Data	6	0.35	25

Pacific Coast Shredder Data	144	0.35	29
Pacific Coast Shredder Data	7	0.36	21
Pacific Coast Shredder Data	24	0.36	23
Nichols Brothers' Treatability Study	12	0.36	21
Nichols Brothers' Treatability Study	9	0.36	21
Nichols Brothers' Treatability Study	10	0.36	25
Nichols Brothers' Treatability Study	10	0.36	33
Nichols Brothers' Treatability Study	11	0.37	30
Nichols Brothers' Treatability Study	12	0.37	22
Nichols Brothers' DMR Data	25	0.37	24
Nichols Brothers' DMR Data	24	0.37	21
Nichols Brothers' DMR Data	9	0.38	30
Nichols Brothers' DMR Data	5	0.38	22
Nichols Brothers' DMR Data	10	0.38	26
Nichols Brothers' DMR Data	25	0.38	25
Nichols Brothers' DMR Data	10	0.38	20
Nichols Brothers' DMR Data	5	0.38	21
Nichols Brothers' DMR Data	22	0.39	21
Nichols Brothers' DMR Data	9	0.39	22
Nichols Brothers' DMR Data	5	0.39	24
Nichols Brothers' DMR Data	41	0.40	20
Exterior Wood lab study Data	5	0.40	34
Exterior Wood lab study Data	17	0.40	24
Exterior Wood lab study Data	11	0.41	26
Exterior Wood lab study Data	15	0.41	26
Exterior Wood lab study Data	14	0.41	18
Exterior Wood lab study Data	666	0.41	22
Exterior Wood lab study Data	554	0.41	25
Exterior Wood lab study Data	36	0.42	20
Exterior Wood lab study Data	43	0.42	25
Exterior Wood lab study Data	21	0.42	18
Exterior Wood lab study Data	21	0.42	19
Exterior Wood lab study Data	35	0.42	23
		0.42	21
		0.42	26
		0.42	22
		0.42	22
		0.42	28
		0.43	18
		0.43	20
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0.46	21
0.46	23
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1.60	8
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1.80	69
1.80	120
1.80	48
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1.90	78
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2.00	50
2.00	46
2.00	51
2.00	97
2.00	43
2.00	100
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2.40	81
2.40	87
2.50	46
2.50	73
2.50	78
2.50	81
2.50	58
2.50	87
2.50	120
2.60	100
2.60	120
2.60	94
2.60	93
2.60	48
2.70	58
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2.70	91
2.70	100
2.80	40
2.80	83
2.80	52
2.80	69
2.80	96
2.80	120
2.90	63
2.90	61
3.00	88
3.00	82
3.00	57
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3.40	100
3.40	16
3.50	59
3.50	67
3.60	98
3.60	95
3.60	84
3.60	110
3.70	110
3.80	35
3.80	75
3.80	110
3.90	110
4.00	120
4.20	120
4.30	110
4.40	130
4.60	140
4.70	86
5.00	130
5.20	140
5.20	64
5.20	150
5.20	130
5.30	82
5.30	140
5.30	85
5.30	160
5.50	91
5.60	170
5.70	130
5.80	160
6.00	100
6.10	92
6.10	77
6.60	160
6.80	140
6.80	120
7.00	100
7.10	130
7.20	78
7.20	160
7.20	150
7.30	160
7.30	160
7.40	180

7.60	190
7.80	170
7.80	130
7.90	180
8.00	160
8.00	180

DEPARTMENT OF THE NAVY

PUGET SOUND NAVAL SHIPYARD
AND INTERMEDIATE MAINTENANCE FACILITY
1400 FARRAGUT AVENUE
BREMERTON, WASHINGTON 98314-5001

Susan

IN REPLY REFER TO:
5090
Ser 106.32/0056
FEB 27 2009

Ms. Jeanne Tran
Water Quality Engineer
Department Of Ecology
Northwest Regional Office
3190 160th Av SE
Bellevue, WA 98008-5452

Dear Ms. Tran,

Thank you very much for forwarding Environmental Protection Agency (EPA) and Washington Department of Ecology's (WDOE) comments to Puget Sound Naval Shipyard and Intermediate Maintenance Facility's (PSNS & IMF) draft All Known Available Reasonable Technology (AKART) study. Enclosure (1) contains PSNS & IMF's responses to these comments. Where appropriate, as indicated in Enclosure (1), PSNS & IMF will update the draft AKART study to include the additional information and/or clarification requested.

After incorporation of comments, we will be routing the AKART study for final review by our senior management and signature of the Shipyard Commander. We hope to have the signed AKART study to you by March 30, 2009.

Questions or comments regarding this information may be addressed to Mr. Bruce Beckwith, Code 106.32 at telephone number (360) 476-0118.

Sincerely,

S Rupp

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Head, Environmental Division
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Enclosure: Response to AKART Comments

Copy to:
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RESPONSE TO AKART COMMENTS

Enclosure (1)

Response to AKART Comments

Com'nt No	Comment	Response
1.	Chlorine is used as additive in cooling water…If a mixing zone for chlorine is needed, then this pollutant needs to be included in the AKART Study.	After further evaluation, we have concluded that it is not reasonable for chlorine to exceed water quality criteria in the dry dock discharges based on the contribution of potable water. The initial determination referred to in the AKART study was made using very conservative assumptions. Based on the low levels of chlorine in the source water, the short half-life of free chlorine, and the amount of mixing with other sources of water before discharge, it is unlikely that dry-dock discharges will exceed WQC at the point of compliance. The chlorine limit as stated in the draft permit does need to be clarified. The draft permit states the chlorine limit as "Total Residual Chlorine (TRC)." According to EPA's, "Aquatic Life Water Criteria for Chlorine" [EPA 440/5-84-030], TRC is used for freshwater and CPO for marine water. It is true that other discharges to marine waters, such as municipal wastewater treatment plants, have limits stated in TRC; however these discharges are freshwater discharges into marine waters. The discharges from dry-docks are mostly marine water. 1. Standard Methods (21 edition) states in 4500-Cl A "None of these methods is applicable to estuarine or marine waters because the bromide is converted to bromine and bromamines, which are detected as free or total chlorine." 2. The chlorine limit in the draft permit is well below achievable quantification levels. The DPD FAS Titrimetric Method 4500-CL F has a published minimum detectable level of 18 ug Cl as Cl^2/L. Standard Methods also includes the note, "This detection limit is achievable under ideal conditions; normal working detection limits typically are higher." When one considers that the holding time for chlorine in CFR 136 is 15 minutes, this analysis will have to take place in the field making it impossible to achieve these low quantification levels. Action: We will revise the wording in the AKART study.

Com'nt No	Comment	Response
2.	PSNS also identified zinc as a POC..., but no AKART discussion for zinc is included in the rest of the document. Again, if a mixing zone for zinc is needed, then this pollutant needs to be included in the AKART study.	PSNS&IMF is requesting a mixing zone for zinc. The Study does not clearly relay a key point that the AKART evaluation for treatment/control of copper will result in treatment/control of zinc as well as other pollutants. Page 138 does state "Overall there is no likely AKART driver stemming from zinc since copper is more critical (controlling factor). AKART implementation from copper limitations will lend itself to equal or greater control of zinc." The Study will be modified to relay this point more effectively. The Study will also be modified to relay the more general point that while a treatment system may be designed for a particular pollutant it will effectively remove other pollutants. This is strongly the case when considering copper and zinc. Action: We will revise the wording in the AKART study.
3.	...we recommend that PSNS make arrangements with the laboratory as soon as possible to switch to a detection limit less than the proposed permit limits...This should be fairly easily implemented by any accredited laboratory...	Quantifying copper to less than 10 ppb in saltwater is not easy and is significantly more expensive than analyzing for copper in fresh water. The statement, "This should be fairly easily implemented by any accredited laboratory" severely underestimates the difficulty of quantifying copper concentrations below 2.5 ppb in saltwater. There are a limited number of labs in Washington that are setup to achieve this quantification level. For example: – AmTest reports copper to 1 ppb but only for freshwater not seawater samples. – The lowest reporting level that Pace Analytical (used to be Laucks Testing Laboratory) can support is approximately 2.5 ppb in seawater. – Columbia Analytical (Kelso, WA) can report as low as 0.1 ppb Cu in seawater. They use a preparatory method of preconcentration by reductive precipitation (EPA Method 1640). In addition to the higher analytical cost, the cost of collecting the samples will be greater. The procedures of collecting sampling for these low quantification levels requires "clean" sampling techniques including using two samplers (dirty/clean hands) and specially cleaned sample containers. Collection of composite samples is more complex. Special cleaning procedures are required for using automated samplers for collection of composite samples. Action: We are currently working with our Shipyard laboratory to achieve a copper quantification level of at least 2.5 ppb.

Com'nt No	Comment	Response
4.	Page 59, the last sentence of the first paragraph, indicates that wastewater consisting of potable water is being discharge to Sinclair Inlet. It implies that this potable water is one source of the wastewater being directed to the drydock floors and discharge to Sinclair Inlet by means of the drydock drainage system. The text on page 67 indicates that water directed to the dry dock floors includes hull wash water, steam condensate, and freeze protection water.	No comment.
4.a	What is potable water being used for on dry docks *[sic]*?	The majority of the potable water discharged to the drydock is freeze protection or single-pass cooling water. Smaller amounts come from leaks in supply lines, portable eyewash stations, drinking fountains, and flushing of potable water systems. Potable water may be used to rinse the salt from the vessel hull and the silt from the dry dock floor immediately following the docking of a vessel. When rinsing the salt from the vessel hull, the pressure is restricted to the pressure of the Shipyard's potable water main (< 150 psi). All water from pressure-washing or washing using mechanical devices such as brooms or brushes is collected and sent to treatment. Action: No action required. Table 5-4 of the study list sources of potable water.
4.b	Any water that contacts the dry dock floors has the potential to wash contaminates to Sinclair Inlet. Of the three waste streams that comprise the dry dock discharge, the dry dock floor drainage has the highest concentration of contaminants.	We agree that water that contacts the dry dock floor has the greatest potential to be contaminated just as any stormwater that contacts the ground, but this doesn't mean that all water that contacts the dock floor is contaminated. Our extensive source control measures along with regular cleaning of the dock minimize the accumulation of contaminates on the dock floor. (See the response to comment 4.c) When it is not raining the majority of the water running off the dock floor is clean. In addition, stormwater following several hours of heavy rain is also clean. The Process Water Collection System is used as second layer of control and is designed to divert the contaminated water to the sewer. Our experience is that the non-stormwater water discharges are clean in that they consist of groundwater infiltration along with potable water and tend to run continually. Action: No action required.

Com'nt No	Comment	Response
4.c	We highly recommend that PSNS focus on providing source control …	PSNS&IMF does focus on source control and dry dock cleaning as described in sections 7.1, 7.5, and 7.8 of the AKART study. These sections of the study cover the conventional Best Management Practices, the extensive use of source control including total containment of blasting along with other innovative controls, and cleaning of the dock floor. These controls have proved to be very effective as demonstrated by the statement made by EPA's inspector during our last multi-media inspection, "Your dry docks are cleaner than my kitchen." Action: No action required.
4.d	We highly recommend that PSNS focus on … treatment for the dry dock floor drainage/stormwater, …	We use our PWCS as a backup to the primary method of control and for monitoring the effectiveness of these controls. The effectiveness of the PWCS compared to the electro-coagulation system suggested by WDOE is covered in Enclosure 1, section 2. Action: No action required.
4.e	…as it is the most contaminated of the three wastestreams.	The statement that dry dock floor drainage is the most contaminated of the three waste streams is misleading. As stated above, although the runoff has the potential to be contaminated, the majority of the time it is clean. Action: No action required.
4.f	Currently, the only treatment provided for the drydock floor drainage/stormwater is the removal of heavy particles in settling basins.	This statement is incorrect. In addition to the settling basins, contaminated water is diverted to the sewer based on continuous monitoring of turbidity. Chapter 11 of the AKART study includes a discussion of our current treatment system along with an evaluation of other options. The conclusion section 11.4 of the AKART study is that our treatment of dry-dock floor runoff exceeds AKART. As discussed in item 7.g and Enclosure 1's comparison of PSNS&IMF's PWCS and WaterTectonics' electro-coagulation, the treatment efficiency of our PWCS compares favorably. It is interesting to note that the WaveIonics system also relies on turbidity for monitoring its effluent and includes the provision to redirect the effluent of the plant back to the treatment system when the turbidity of the treated effluent is high. In other words, the WaveIonics system relies on turbidity for controlling contaminates. Action: No action required.

Com'nt No	Comment	Response
5.	The AKART analysis of the piers is somewhat limited. Page 95 states that heavy industrial operations do not occur on piers. Are metal cutting and painting operations prohibited on the piers?	Metal cutting and painting operations do occur on piers but in a much more limited fashion than occurs in our dry docks. However all operations carried out on our piers are subject to all the BMPs applicable to the work being performed which means that painting, sanding, chipping operations must be carried out in a containment capable of preventing debris from entering the environment. BMP # 9 covers the requirements for over-water work being performed on vessels moored pier side. PSNS&IMF prohibits the storage of hazardous waste and Washington State Dangerous Waste on piers and other over-water structures unless specific authorization is granted. The Oil & Hazardous Substance (OHS) Spill Prevention Plan prohibits portable fuel tanks from piers and barges as well as prohibiting any fueling or defueling of vehicles and equipment on piers without evaluation on a case-by-case basis from Code 106.3. Action: We will clarify the BMP requirements in the AKART study.
6.a	It is unclear whether the copper and turbidity correlation is applicable at the low copper concentrations regulated under the NPDES permit. The scale on Figure 6 is 0 to 2,000 ug/L. The NPDES permit is concerned with low levels of copper; The benchmark level for stormwater is 20 ug/L for copper. Although difficult to discern from the scale of the figure, it appears there is little correlation between turbidity and copper in this lower range. Please include a graph which highlights the data in the lower copper concentration range (e.g. 1 to 50 µg/L).	The attached comparison (see Enclosure 1, section 2) of PSNS&IMF's PWCS and WaterTectonics' electro-coagulation shows that there is a significant correlation between turbidity and copper well below 10 NTU and 200 µg/L. It is true that the correlation between turbidity and copper decreases below 5 NTU, however the performance of the PWCS is similar to the WaveIonics system for copper and performs much better for zinc. The bottom line is the PWCS exceeds AKART for copper and zinc. See additional information in item 7.g. As discussed in our comments to the draft permit, the benchmark level of 20 µg/L for copper is not consistent with other industrial permits. The current State Industrial General Permit contains a total copper action level of 149 µg/L and a benchmark level of 63.6 µg/L. The benchmark level for copper in EPA's current MSGP is 63.6 µg/L. (The 2008 MSGP which is not available in Region 10 has a benchmark of 33.2 µg/L.) As requested Enclosure 1, section 1 contains an expanded graph of turbidity and copper highlighting the relationship at the lower end of turbidity and copper. Action: We will add the expanded graph to the AKART study.

Com'nt No	Comment	Response
6.b	It is our understanding that PSNS generally uses a trigger concentration of 25 NTU to divert the waste stream to the sanitary sewer. On page 61, it states than the median copper concentration below 5 NTU is 31 µg/L, with 95 percent of the water samples being below 90 µg/L. Therefore, using 25 NTU as the trigger to direct waste streams to the sanitary sewer would allow waste streams to discharge to Sinclair Inlet at much greater concentrations than the benchmark of 20 µg/L.	First, as explained in the section 11.3 of the AKART study, it is difficult to compare turbidity values obtained using different meters, monitoring different waste streams. The 25 NTU set point was based on using a GLI turbidity meter. We found that this meter indicates a turbidity value of twice the value measured in the lab. The NTU values in the AKART study used to demonstrate the relationship of copper to turbidity were measured in the lab. The 25 NTU read on the GLI would therefore be equivalent to approximately 13 NTU based on values measured in the lab. We are in the process of replacing the GLI meters. The new turbidity meter reads approximately half the value read by the GLI consistent with the values measured in the lab. Action: No action required.
6.c	PSNS should examine the option of lowering the diversion threshold of turbidity from 25 NTU.	We have already lowered the diversion threshold, however the set point used divert water to the sewer has to balance the concentration of copper allowed to be discharged to the bay and the amount of water we are allowed to send to the sewer. The City of Bremerton has increased our sewer allotment allowing us to reduce the set point to 8 NTU. We are continuing to work with the City to further increase our allowable sewer allotment. Action: No additional action required.
6.d	We also recommend that PSNS explore the option of treatment to remove copper and other contaminants prior to discharge to Sinclair Inlet.	The Navy shares your interest in finding effective treatment options for heavy metals in stormwater and dry-dock runoff. Sections 12.7.5 and 12.7.6 of the AKART study discusses options that have been considered. As discussed in section 11.5.2 of the AKART study, the Shipyard is in the processing of increasing the capacity and removal efficiency of our bilge water treatment systems. This will allow us to collect and treat stormwater that exceeds the capacity of the sewer system. The new bilge water treatment systems use hydroxide precipitation followed by a polishing filter and are designed to treat water to less than 10 ppb copper. Action: No action required.
7.a	An effort should be made to reduce the volume of non-contact cooling water and explore the option of converting it to a closed-loop system to achieve zero discharge if it is possible, or providing cooling through chillers.	We will modify the AKART study to more clearly define the limits on reducing both the volume and temperature of cooling water. Specific comments are addressed below. Action: We will modify the AKART study.

Com'nt No	Comment	Response
7.b	As stated in Section 2.2.2 *[sic]* (page 69), cooling is needed only for nuclear powered naval vessels (as opposed to all vessels being serviced at the shipyard.	The AKART study is incorrect in stating that only nuclear vessels require cooling. It is true that maintaining cooling water to nuclear reactors is a critical requirement; however non-nuclear vessels also use cooling water for diesels, air conditioning plants, propulsion plant equipment, and cooling of electrical components. That said, the vast majority of vessels undergoing maintenance at PSNS&IMF are Nuclear. For example, a breakdown of our current workload projection through 2019 shows a total of 82 projects. These projects include 14 recycling job, 67 nuclear vessel maintenance ops and 1 non-nuclear vessel maintenance op. Action: We will modify the AKART study.
7.c	It is understood that vessels, including non-nuclear vessels, and undergoing ship breaking activities, do not need cooling). Thus, perhaps two to three chillers may be sufficient as opposed to one installation for each drydock as stated on page 75.	This statement is not realistic. While PSNS&IMF would utilize consolidated chiller plants where feasible, the statement implies that only limited total cooling would be needed. This is incorrect because essentially the entire workload of PSNS&IMF is devoted to servicing nuclear powered vessels. Only Drydock 3 services exclusively ship breaking activities. Dry-docks 2 through 6 service active nuclear ships. The AKART study already acknowledges that vessels in dry dock 3 do not require cooling. Action: No action required.
7.d	For the cooling towers option, to prevent scale deposition, periodic back flushing of the cooling towers may be necessary.	Based on section 12.7.2 of the AKART study, the discussion on preventing scale deposition in cooling towers is irrelevant. Cooling towers are physically not capable of cooling water to 16 degrees C. Action: No action required.

Com'nt No	Comment	Response
7.e	For the cooling water reduction initiatives option, we support the proposal of reducing the designed flow rate to be closer to the flow rate actually required, and replacing the single pass cooling systems with small heat exchangers or chillers.	Reducing the vessel cooling water flow rates will not necessarily achieve the desired results. There are two pollutants of concern involved with cooling water, temperature and copper. One must understand that actions taken to minimize one pollutant may exasperate the other. For example reducing the volume of cooling water to reduce the amount of copper discharged will increase the temperature of the discharge. The amount of heat (BTUs) that must be removed remains unchanged. Flow rate reductions are only effective if they actually reduce the actual heat load. Merely reducing cooling water flow rate has the negative effect of increasing effluent cooling water discharge temperatures from the ship system. For reasons of economic cost, PSNS&IMF already limits cooling water systems to essential systems only. Therefore, from a practical standpoint, there is little or no opportunity for further reduction of heat load. Replacing single-pass cooling systems on vessels is not an option. These systems are part of the ship's design and exist on most vessels (Navy, commercial and recreational). Use of alternate cooling methods for cooling the discharge water, such as air cooled refrigerant water chillers for cooling small components normally using once-through cooling water, offers little reduction in the total heat load, typically far less than 5%. Since this type of cooling requires invasive connections to ship systems, it can be applied for only limited time periods due to the time required for disassembly and later reassembly of the affected systems. The Shipyard does have some equipment that uses single pass cooling. We have converted a number of these to air heat exchangers; however the contribution of heat from these units is minimal. Action: No action required.

Com'nt No	Comment	Response
7.f	For the oily water treatment system option, the cost would be significantly reduced by treating the volume of the most contaminated waste stream; such as the dry dock-floor drainage, as opposed to treating the combined volume of dry dock drainage, non-contact cooling water and hydrostatic relief water.	Section 12 of the AKART study addresses only cooling and groundwater discharges, not dry-dock floor discharges. Treatment options for dry-dock floor discharges are in Section 11. We agree that treatment should be applied to dry-dock floor drainage rather than treating all the water discharged. This is the principle used by our Process Water Collection System. The problem with meeting the copper limits in the draft permit is that copper contribution from cooling water (with no contribution from the dry dock floor) can cause an exceedance of the discharge concentration. Although the concentration of copper in cooling water is relatively low, the large volume makes it a significant contributor to the combined discharge. Action: No action required.

Com'nt No	Comment	Response
7.g	For the electro-coagulation treatment option, page 78 states that there is not enough data to consider electro-coagulation treatment as an AKART treatment technology for the removal of dissolved copper. According to the available literature, this treatment technology can remove dissolved metals. Attached are some data generated from several facilities removing dissolved copper using electro-coagulation. We suggest that PSNS may review the data and consider reevaluation this treatment option as many facilities have conducted pilot studies and concluded it to be a feasible AKART treatment option.	Our AKART study's discussion of electro-coagulation was based on material that was available to us at that time. Based on this information we concluded that electro-coagulation was not a reasonable treatment option for PSNS&IMF. We have since reviewed the additional data provided by WDOE. Although electro-coagulation may be a valid treatment option for some facilities, it would not be an improvement over our current combination of our stringent source controls in conjunction with our PWCS. A summary of our findings is listed below with supporting material in Enclosure 1, section 2. – The DMR data from the installed system at Nichols' Brothers and Pacific Shredders along with tractability study data from Exterior Wood Inc. does not support the vendor's claim that electro-coagulation can meet WQC copper and zinc discharge limits. None of the copper samples from Nichols Brothers' DMR are below water quality criteria and three of the 12 samples exceed the zinc acute criteria. – The majority of the electro-coagulation data are from treatability studies. As demonstrated by the limited DMR data provided by WDOE, one cannot assume that the equipment will be able to achieve similar results when deployed in the field. – It is our understanding that although extensive testing of the electro-coagulation system was done at Pacific Fisherman, Pacific Fisherman choose not to proceed with installation. – Our PWCS compares favorably with WaveIonics for treating copper and far exceeds it for zinc. Enclosure 1, section 2 compares the distribution of copper and zinc concentrations in the water the PWCS discharges to the bay with the treated effluent of the WaveIonics system. Comparing the distribution of discharge concentrations shows that the WaveIonics performs better at low copper and zinc concentrations, but is often overwhelmed by high concentrations. This is especially true for zinc where the system has significantly lower removal efficiency. The treated effluent of WaveIonics data shows concentrations of copper as high as 666 ppb and zinc as high as 12,7000 ppb. – The WaveIonics treatment requires significantly more space in that it requires sedimentation tanks both before and following treatment. It would be extremely difficult to install this system considering the space restrictions in the shipyard. Action: No further action required.

Com'nt No	Comment	Response
8.	Estimated compliance position for copper with the proposed limit in stormwater: Page 19, Table 5-4 states that the mean concentration of copper in stormwater is 63 µg/L and will therefore regularly exceed the proposed limit in the working draft permit. AKART for copper removal in stormwater should be included in the study in order qualify for a mixing zone.	The AKART study discusses stormwater options in section 14.4 and concludes the "end-of-pipe" stormwater treatment is not practical; however, significant reductions are possible through increased source control and enhanced street sweeping. Even though the exact metal concentration reduction is unknown, the proposed methods will substantially contain and remove contaminants that may come in contact with non-dry dock storm water. Action: No action required.
9.	One of our concerns with ship cooling water is having the cooling water wash contaminants from the dry dock floor into Sinclair Inlet. For this reason, the working draft permit contains a provision that prohibits the direct discharge of ship cooling water that contacts the dock floor. The intent of this provision is to prevent contact of the cooling water with spent abrasives, paint chips, and other debris. Page 72 states that for a typical vessel, it takes one week to route the cooling water to the dry dock drainage. For aircraft carriers, two weeks are needed due to the additional time to takes to route the numerous sources of cooling water. We understand that time is needed to route the cooling water, however, the cooling must be routed directly to the dry dock drainage system, prior to the start of industrial operations in the dry docks.	We agree that cooling water needs to be routed to the drainage system prior to the start of industrial work and is already invoked in current shipyard policy. Action: No action required.

Com'nt No	Comment	Response
10.	Wash water (e.g. floor wash water) – The AKART study doesn't appear to adequately address wash water. The working draft permit prohibits the direct discharge of wash water to Sinclair Inlet, because of the potential for wash water to come into contact with pollutants and wash the pollutants to Sinclair Inlet. In PSNS's comments to EPA on the working draft permit, PSNS described the need to discharge wash water to the bay following the flooding of the dry dock. However, with the exception of washing bay silt back to Sinclair Inlet following the flooding of the dry dock, all wash water in the dry dock must be directed to the sanitary sewer, or be treated prior to discharge to Sinclair Inlet. Wash water in industrial areas outside of the dry docks should be directed to the sanitary sewer or treatment.	This comment addresses three situations involving pavement washdown. – The first is the washdown of bay-silt following the dewatering of the dry-dock. We agree that washing bay-silt back to the bay is appropriate. – The second is washing industrial debris from the dry dock floor. We agree that this water should be collected and treated or discharged to the sanitary sewer. – The third is routine external building washdown and pavement washdown outside the dry docks and not contaminated with industrial debris. We believe that the requirements for this water should be consistent with EPA's MSGP. Pier and deck surfaces near the water accumulate large amounts of bird waste and shells. This is material that would have been naturally deposited in the water in the absence of the pier or vessel. We require that the loose material be broom-cleaned prior to washing; however washing is the only method that can effectively remove the material deposited on rough surfaces. In most cases, the option to discharge this material to the sanitary sewer is not available. Action: We will clarify the dry-dock washing requirements in the BMPs listed in the AKART study, however we believe that the draft permit's ban on the discharge of all pavement wash water is inconsistent with EPA's MSGP.

Com'nt No	Comment	Response
11.	Page 25, Table 6-4 – The draft AKART study addresses metal cutting only outside of the dry docks. However, metal cutting does occur within the dry docks. Any dry dock floor drainage collected during metal cutting operations should be collected and sent to treatment.	Concur. Section 6 is not clear with regard to metal cutting in the dry docks. It is indirectly addressed in the noted table as "Stormwater Management (D3)" since some of the debris is transported in stormwater. Section 6 will be augmented to address the matter. Other sections of the study, however, do address metal cutting. Section 11 states: "Hull-burning [metal cutting] is the process used for recycling decommissioned vessels. During this process an oxy-fuel cutting torch is used to cut the vessels into sections that can be moved from the dry dock to an in-door cutting facility. The BMP for this process is to do as much of the cutting as possible in-doors and clean up the burn slag in the dock." Section 11 also discusses the Process Water Collection Systems, which monitor dry dock stormwater quality and diverts stormwater into the sanitary sewer when lower quality stormwater is detected. All dry dock stormwater is pretreated in settling basins. Section 15 discusses current BMP 2, Dry Dock Cleanup, which requires personnel working in the dry dock to clean the dock by the end of each shift. Section 15 discusses, and Attachment 7 contains, proposed new dry dock BMPs such as DD-BMP 11, Outdoor Metal Work. This BMP, which mirrors the non-dry dock BMP of the same name, requires metal work areas be constructed to prevent rainwater from contacting the work process and/or debris. Action: We will clarify Section 6 of the AKART study.

Com'nt No	Comment	Response
12.	"We highly recommend that this (metal working) BMP be revised to contain a description of the containment measures to be undertaken for specific activities."	As described in section 7.5 of the AKART study containments are used for a wide range of work processes (abrasive blasting, slurry blasting, painting, grinding, cutting, hydroblasting, etc.), for varying size of operations (containment of complete vessels to a small glove bag), and various work environments (dry-docks, over-water, shop facilities, building renovations, etc.) Improvements are constantly made based on the lessons learned for previous projects. It is not desirable (or possible) to specify the specific design elements for containment. It is better to have a BMP that lists the performance specifications of the containment. In addition, contractors working at our facility will have their own methods and expertise for controlling debris. As a matter of policy the environmental division limits itself to describing the performance specifications required for environmental controls. The cognizant technical engineers are then free to design the most effective and efficient containment for each application. Containments are regularly inspected to make sure that they are performing as required. Currently, PSNS&IMF requires that all metalworking be done in a containment capable of preventing debris from entering the environment and preventing rainwater from contacting work surfaces or debris generated from the work. Action: No action required.
13.	Page 86, Section 13.2.3 – Recycle Materials Transfer Site (RMTS): Please include the proposed construction schedule for the area so that stormwater can be appropriately direct to the treatment unit.	The paving and changes to the stormwater piping are tentatively budgeted for the first quarter of FY 2010. The design has already been completed and construction should take approximately six months. We must note that funding for this project is dependent upon the Congressional approval of Navy funds. Action: We will add the above information to Section 13.2.3.
14.	Pages 95 and 96, Section 14.4.4.3 Option 3 – Primary Source Control and Enhanced Surface Cleaning: PSNS proposes to implement this option by enclosing all copper anti-fouling spray-painting operations along with enhancing street-sweeping to minimize pollutants from coming in contact with stormwater. We highly support this proposal. Does PSNS have a proposed construction schedule for this project?	In response to our recent Notice of Violation issued by EPA, we have been enclosing all copper anti-fouling spray-painting operations since March 2008. Containments are custom built for each application. We are in the process of researching the availability of sweepers, collecting cost information. We will provide additional information separately. Action: Will provide information.

Com'nt No	Comment	Response
15.	Page 115, Table 16-2 – Proposed Working Draft Permit Limits: The oil & grease limits listed on that table are reversed.	Action: This will be corrected in the next draft
16.	Page 158: Please identify the "high risk" work areas. How do they compare to the stormwater zones identified in Section 14?	The high-risk work areas referred to on page 158 are the areas adjacent to the dry docks where our heaviest industrial work is preformed. These areas are contained within the zones 1 through 6 identified in Section 14. Action: No action required.

Evaluation of PSNS & IMF's PWCS

Reference (a) Washington State Department of Ecology. Comments on the Second Draft of All Known Available Reasonable Treatment (AKART) Study, January 8, 2009

1. Copper/Turbidity Relationship

Reference (a), comment 6, requested that the graph showing the relationship between copper and turbidity be expanded to show the relationship at the lower end of the turbidity/copper range. Figure 1 shows the expanded graph. It is true that the correlation between copper and turbidity decreases for turbidities less than 5 NTU and copper concentrations less than 75 ppb. This lack of correlation is the result of the difficulty in consistently measuring copper at these low levels along with the obvious lack of correlation between turbidity and dissolved copper. However, even though there isn't a good correlation at low levels, using turbidity to control the diversion of contaminated stormwater to sewer is an effective method of control and compares favorably with other treatment options including electro-coagulation.

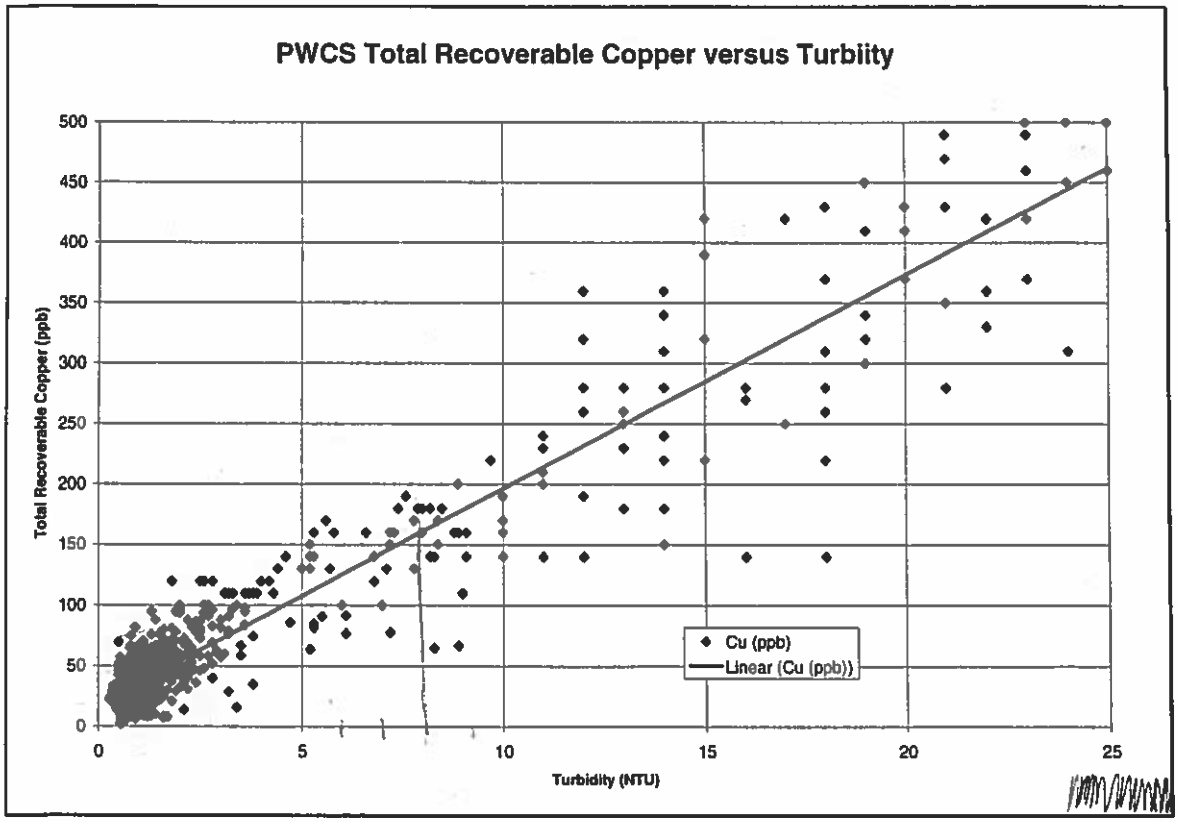

Figure 1

2. PWCS Effectiveness Compared to Electro-coagulation

Reference (a), comment 4, included that statement, "the only treatment provided for the drydock floor drainage/stormwater is the removal of heavy particles in settling basins." This statement is incorrect. Our PWCS does provide efficient treatment.

One significant advantage of the PWCS is that since higher concentrations of copper are always associated with increased turbidity, the PWCS is capable of achieving 100% "treatment" of the most contaminated water by diverting it to the sanitary sewer. This is not the case for treatment options such as electro-coagulation. These treatment systems may have effective removal efficiencies, however for influent water with high levels of contaminates, even removal efficiencies of 80% will discharge high levels of contaminates. The data provided by WDOE (summarized in Figure 5) demonstrates this with treated effluent concentrations of the electro-coagulation system as high as 666 ppb for copper and 12,700 ppb for zinc. (For comparison, the highest levels for the PWCS are 140 ppb for copper and 620 for zinc as shown in Figure 4.)

As a review of the PWCS operation, the Figure 2 shows the performance of our dry dock 1's PWCS on January 6th and 7th. The PWCS at dry dock 1 is set to redirect water from the dry dock floor to the sanitary sewer when the turbidity of the floor runoff water reaches 8 NTU and will continue to discharge to the sewer until either the turbidity drops below approximately 6 NTU or the total water discharged to the sewer from dry dock 1 reaches the daily sewer allotment for this dock. On January 6th the sewer allotment for dry dock 1 was set to 35,000 gallons. As shown by the figure below, the PWCS diverted 14,000 gallons to the sewer on January 6 and another 8,000 on January 7 while runoff with a turbidity of less than 8 NTU was discharged to the bay.

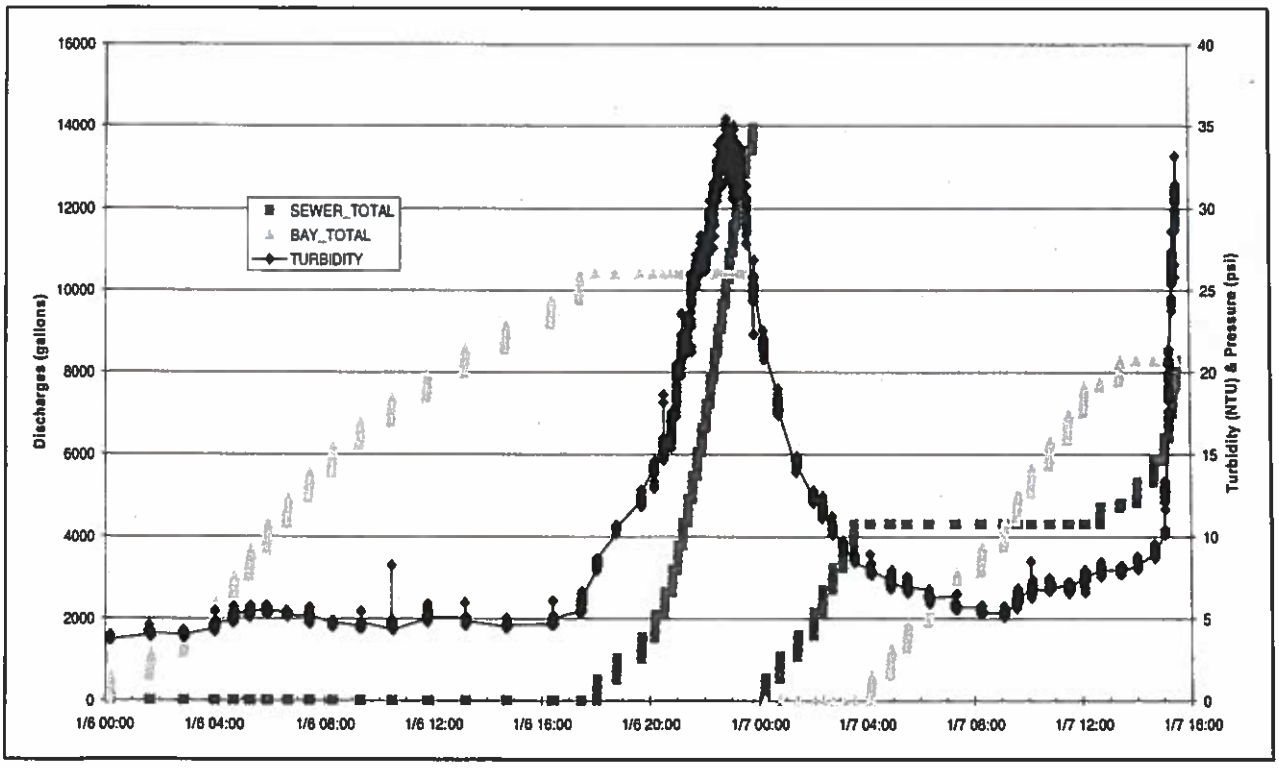

Figure 2

The PWCS compares favorably to WaterTectonics' electro-coagulation system based on the WaterTectonics' data provided by WDOE. Our AKART study included the table shown in Figure 3 demonstrating the effectiveness of the PWCS method of diverting water to the sewer based on turbidity.

Percentile	Total Recoverable Cu (ppb) With a Maximum Turbidity of 5 NTU	8 NTU	10 NTU
50%	*31*	32	33
60%	37	39	39
70%	44	46	47
80%	52	55	58
90%	67	78	86
95%	*87*	100	120
99%	114	160	179
100%	140	190	220

Figure 3

Figures 4 and 5 below use this same method to compare the PWCS and WaveTectonics' electro-coagulation system. The PWCS data was collect during PSNS & IMF's study of turbidity as a control mechanism for copper and zinc. (This same data is compared graphical in Figures 6 and 7.) The WaveTectonics' data includes 55 samples for copper and 33 for zinc.

- field and DMR samples from Pacific Coast Shredders
- study samples from Exterior Wood Inc., and
- treatability and DMR samples from Nichols Brothers Boat Builders

The information in the Process Water Collection System table is based on approximately 1,000 samples taken over a number of months from two different dry docks.

Process Water Collection System

Percentile	Total Recoverable w/ Turbidity < 5 NTU Cu (ppb)	Zn (ppb)
50%	36	190
60%	42	200
70%	48	210
80%	57	230
90%	71	300
95%	88	370
99%	112	520
100%	220	630

Figure 4

WaveIonics Electro-coagulation

Percentile	Total Recoverable Cu (ppb)	Zn (ppb)
50%	13	190
60%	18	233
70%	24	376
80%	35	1,356
90%	47	2,474
95%	152	4,844
99%	609	9,444
100%	666	12,700

Figure 5

Comparing the distribution of discharge concentrations of the WaveIonics and PWCS shows that the WaveIonics performs better at low copper and zinc concentrations, but is often overwhelmed by high concentrations. This is especially true for zinc where the system has significantly lower removal efficiency. As described above, the PWCS achieves 100% removal for influents with these high concentrations.

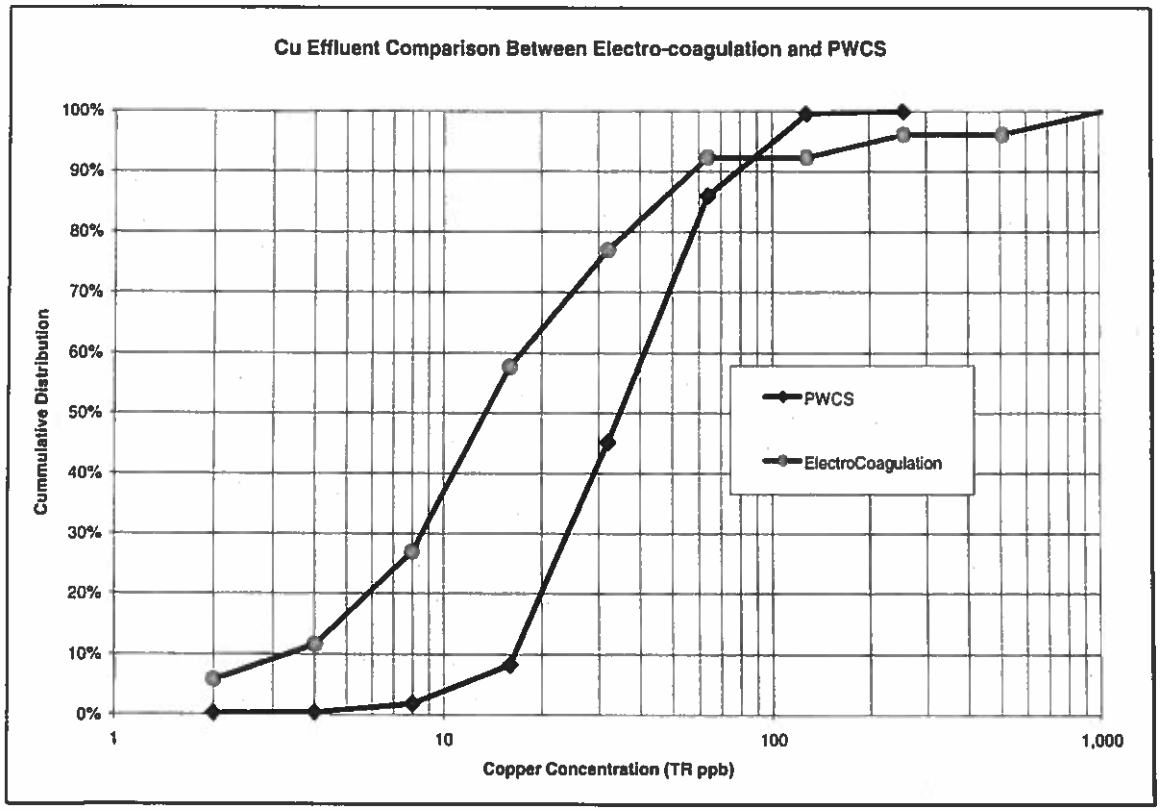
Cu Effluent Comparison Between Electro-coagulation and PWCS
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Cummulative Distribution
1
10
100
1,000
Copper Concentration (TR ppb)
PWCS
ElectroCoagulation

Figure 6

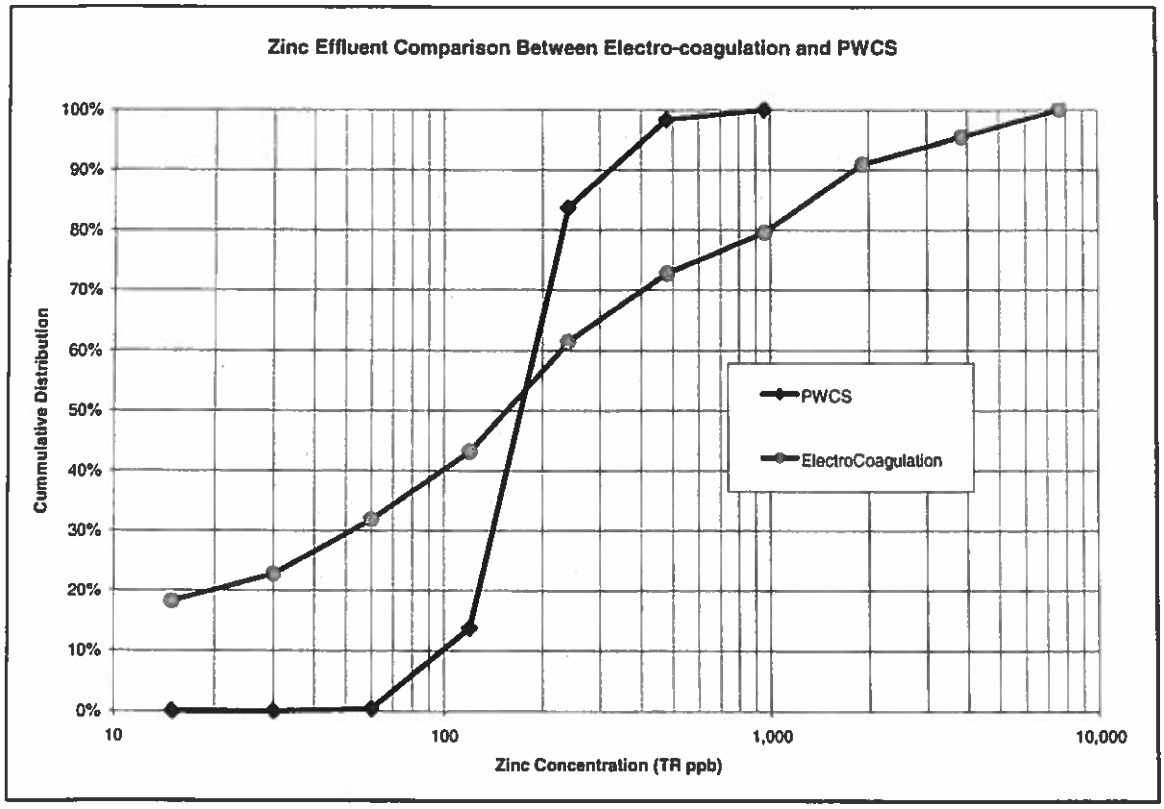
Zinc Effluent Comparison Between Electro-coagulation and PWCS
Cummulative Distribution
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
10
100
1,000
10,000
Zinc Concentration (TR ppb)
PWCS
ElectroCoagulation

Figure 7

Data Used to Compare PWCS with Electro-coagulation

Pacific Coast Shredder

	Influent (ppb)		Effluent (ppb)	
Sampling Date	Copper	Zinc	Copper	Zinc
2/20/07		18,700		500
2/24/07		25,300		3,020
2/24/07		28,200		2,910
2/24/07		25,300		222
2/24/07		28,200		205
2/24/07				335
2/24/07				250
3/26/07		22,000		5,300
4/18/07		20,600		51
4/18/07		20,600		1,350
4/18/07		20,600		17
1/4/07			3	12,700
2/15/07			5	1,510
3/26/07			<2	5,300
4/12/07			<2	96
5/21/07			13	62
10/18/07			6	560
11/20/07			4	384
12/20/07			3	178
6/29/07			<2	12
7/19/07			19	200
8/20/07			12	98
10/18/07			47	200
11/30/07			51	1,430
12/28/07			30	316
2/26/08			34	190
2/26/08			161	1,820
3/14/08			46	342
4/30/08			14	14
5/21/08			6	44
6/9/08			144	1,380
8/25/08			7	88
11/19/08			24	558

Nichols Brothers' Treatability Study (Table 7)

Sampling Date	Influent Copper (ppb)	Effluent Copper (ppb)
	1300	12
	46	9
	58	10
	52	10
	58	11
	57	12

Nichols Brothers' DMR Data

Sampling Date	Effluent Copper (ppb)	Effluent Zinc (ppb)
1-Oct-07	25	135
1-Nov-07	24	92
1-Dec-07	9	41
1-Jan-08	5	14
1-Feb-08	10	15
1-Mar-08	25	12
1-Apr-08	10	8
1-May-08	5	10
1-Jun-08	22	46
1-Jul-08	9	24
1-Aug-08	5	10
1-Nov-08	41	150

Exterior Wood lab study total copper (mg/L)

Sampling Date	Effluent Copper (ppb)
	5
	17
	11
	15
	14
	666
	554
	36
	43
	21
	21
	35

PSNS PWCS Study

Dry Dock	Logged Date	TSS (mg/L)	Turbidity (NTU)	Copper (ppb)	Zinc (ppb)
4	12/13/00 11:31	1	0.93	12	
4	12/13/00 12:19	1	0.79	12	
4	12/13/00 13:08	1	0.87	16	
4	12/13/00 14:12	1	1.00	18	
4	12/13/00 15:04	1	1.50	22	
4	12/13/00 16:13	2	2.20	31	
4	12/13/00 17:05	2	2.00	32	
4	12/13/00 17:58	1	1.20	22	
4	12/13/00 19:07	1	0.79	15	
4	12/13/00 20:00	2	0.76	16	
4	12/13/00 20:53	2	0.68	14	
4	12/13/00 22:02	2	0.62	13	
4	12/13/00 22:55	1	0.66	13	
4	12/13/00 23:48	1	0.65	13	
4	12/14/00 0:57	2	0.72	13	
4	12/14/00 1:49	1	0.80	12	
4	12/14/00 2:41	1	0.67	16	
4	12/14/00 3:49	1	1.20	15	
4	12/14/00 4:41	1	0.89	12	
4	12/14/00 5:33	1	0.79	13	
4	12/14/00 7:06	1	0.66	12	
4	12/14/00 7:58	1	0.66	12	
4	12/14/00 8:52	5	0.60	13	
4	12/14/00 9:55	5	1.80	21	
4	12/14/00 13:43	4	2.60	48	420
4	12/14/00 14:13	10	7.00	100	550
4	12/14/00 14:31	10	7.10	130	650
4	12/14/00 14:51	7	11.00	140	710
4	12/14/00 15:03	9	12.00	140	720
4	12/14/00 15:15	7	10.00	140	810
4	12/14/00 15:22	11	16.00	140	780
4	12/14/00 15:33	13	18.00	140	760
4	12/14/00 15:40	8	14.00	150	770
4	12/14/00 15:52	6	14.00	180	820
4	12/14/00 16:12	5	8.20	180	840
4	12/14/00 16:30	1	8.50	180	820
4	12/14/00 16:54	7	8.90	160	760
4	12/14/00 17:09	4	7.20	150	700
4	12/14/00 17:22	4	8.30	140	660
4	12/14/00 17:26	3	9.10	140	650
4	12/14/00 17:30	3	8.20	140	650
4	12/14/00 19:41	4	6.80	120	650
4	12/15/00 11:07	4	3.40	16	140
4	12/15/00 11:55	2	2.10	14	120
4	12/18/00 12:28	7	0.88	9	76
4	12/18/00 13:09	2	1.40	10	77
4	12/18/00 13:10	5	1.60	8	74
4	12/18/00 13:50	5	1.10	12	96
4	12/18/00 14:32	6	1.10	9	74
4	12/18/00 15:14	5	1.10	12	74
4	12/18/00 15:15	1	0.57	7	
4	12/18/00 15:15	8	0.91	10	76
4	12/18/00 16:09	7	0.93	11	73
4	12/18/00 16:10	5	0.98	9	71
4	12/18/00 16:51	4	0.82	9	70
4	12/18/00 17:33	1	0.82	9	70
4	12/18/00 17:34	1	0.95	9	73
4	12/18/00 17:35	2	0.71	11	87
4	12/18/00 18:15	4	0.84	10	72
4	12/18/00 18:57	1	0.58	5	
4	12/18/00 18:57	1	0.97	10	71
4	12/18/00 19:40	2	0.84	8	70
4	12/18/00 20:22	1	0.62	9	69
4	12/18/00 21:04	1	1.30	9	70

Dry Dock	Logged Date	TSS (mg/L)	Turbidity (NTU)	Copper (ppb)	Zinc (ppb)
4	12/18/00 21:46	1	0.94	9	69
4	12/18/00 22:28	1	0.76	8	71
4	12/18/00 23:23	1	0.88	9	71
4	12/18/00 23:23	1	0.93	8	70
4	12/19/00 0:05	1	1.60	7	68
4	12/19/00 0:47	1	1.20	8	70
4	1/8/01 12:57	9	1.80	120	250
4	1/8/01 15:00	6	2.50	120	240
4	1/8/01 16:25	9	1.30	95	150
4	1/8/01 17:51	6	0.90	82	130
4	1/8/01 18:48	7	1.30	76	120
4	1/8/01 18:48	7	1.40	74	130
4	1/8/01 20:16	7	0.80	75	120
4	1/8/01 22:28	7	0.50	70	110
4	1/9/01 0:53	1	1.00	68	110
4	1/9/01 3:05	1	0.50	64	110
4	1/9/01 3:05	1	0.80	67	110
4	1/9/01 5:30	1	0.78	65	110
4	1/9/01 8:31	1	0.85	59	110
4	1/9/01 10:42	5	0.95	57	100
4	1/9/01 13:06	5	0.54	57	100
4	1/9/01 15:18	1	0.70	54	100
4	1/9/01 17:44	1	1.50	55	100
4	1/9/01 19:07	1	3.60	110	340
4	1/9/01 19:54	3	4.60	140	450
4	1/9/01 21:00	1	5.30	140	450
4	1/9/01 22:40	2	2.00	97	300
4	1/10/01 3:05	1	0.80	59	150
4	1/10/01 5:15	1	0.50	52	130
4	1/10/01 7:27	1	0.50	49	120
4	1/10/01 9:51	1	0.90	48	130
4	1/16/01 12:26	4	1.40		120
4	1/16/01 12:26	9	1.70	8	120
4	1/16/01 13:18	3	0.98		120
4	1/16/01 14:26	2	0.65		120
4	1/16/01 15:18	3	0.94		110
4	1/16/01 15:18	2	1.00		100
4	1/16/01 15:19	3	1.00		100
4	1/16/01 16:26	3	1.10		110
4	1/16/01 17:18	1	0.63		100
4	1/16/01 18:26	2	0.83		100
4	1/16/01 20:27	2	0.79		120
4	1/16/01 21:19	4	0.81		100
4	1/16/01 21:19	2	0.82		110
4	1/16/01 22:27	3	0.73		110
4	1/16/01 23:19	3	0.72		110
4	1/17/01 1:01	3	0.95		110
4	1/17/01 1:02	4	0.77		100
4	1/17/01 1:53	3	0.76		110
4	1/17/01 1:54	13	0.62		100
4	1/17/01 3:01	8	0.73		100
4	1/17/01 5:00	9	0.55		110
4	1/17/01 5:52	10	0.61		120
4	1/17/01 6:59	4	0.91		110
4	1/17/01 7:51	9	0.85		110
4	1/17/01 11:47	4	0.47		120
4	1/17/01 12:38	5	0.63		110
4	1/17/01 13:45	8	0.76		120
4	1/17/01 14:36	12	0.82		120
4	1/17/01 15:41	10	0.92		150
4	1/17/01 15:42	9	0.91		150
4	1/17/01 15:42	10	1.00		150
4	1/17/01 16:27	16	0.94		170
4	1/17/01 18:02	7	2.40	36	310

Dry Dock	Logged Date	TSS (mg/L)	Turbidity (NTU)	Copper (ppb)	Zinc (ppb)
4	1/17/01 18:31	17	5.20	64	420
4	1/17/01 18:59	17	6.10	92	540
4	1/17/01 19:29	13	5.30	85	570
4	1/17/01 20:05	13	5.30	82	570
4	1/17/01 20:44	17	3.50	59	460
4	1/17/01 21:40	14	3.20	29	350
4	1/17/01 21:40	12	3.80	35	370
4	1/17/01 23:09	15	1.00		240
4	1/18/01 0:53	5	1.20		200
4	1/18/01 1:39	16	1.30		190
4	1/18/01 2:39	13	0.97		180
4	1/18/01 3:26	14	0.92		180
4	1/18/01 4:12	14	0.75		200
4	1/18/01 5:13	14	0.78		150
4	1/18/01 5:59	15	0.56		170
4	1/22/01 16:22	21	0.89	25	190
4	1/22/01 17:17	20	0.99	21	180
4	1/22/01 18:00	22	1.00	20	170
4	1/22/01 18:42	21	0.96	20	180
4	1/22/01 19:38	19	0.76	16	180
4	1/22/01 20:21	14	0.84	19	180
4	1/22/01 20:22	23	1.40	19	180
4	1/22/01 21:05	22	0.80	17	180
4	1/22/01 21:05	21	0.96	18	180
4	1/22/01 22:01	20	0.74	18	180
4	1/22/01 22:01	20	0.88	16	180
4	1/22/01 22:44	19	0.80	16	180
4	1/22/01 23:26	19	0.81	15	170
4	1/23/01 0:49	18	0.81	13	170
4	1/23/01 1:32	16	1.10	15	170
4	1/23/01 2:28	21	0.64	15	180
4	1/23/01 2:28	21	0.93	16	180
4	1/23/01 3:11	20	0.85	16	180
4	1/23/01 3:54	20	1.20	13	180
4	1/23/01 4:50	19	0.85	14	180
4	1/23/01 5:32	15	0.62	11	170
4	1/23/01 6:57	16	0.52	11	170
4	1/23/01 7:39	15	0.56	9	180
4	1/23/01 7:39	16	0.87	11	180
4	1/23/01 8:22	18	1.10	12	180
4	1/23/01 12:21	14	0.65	14	140
4	1/23/01 13:19	17	0.71	16	150
4	1/23/01 14:05	19	1.90	44	160
4	1/23/01 14:53	16	1.20	20	130
4	1/23/01 15:55	14	1.30	16	130
4	1/23/01 16:43	16	1.10	11	110
4	1/23/01 17:46	14	0.86	9	120
4	1/23/01 17:46	13	0.95	9	110
4	1/23/01 18:34	15	0.74	9	110
4	1/23/01 18:34	6	1.60	8	110
4	1/23/01 19:37	17	0.66	24	110
4	1/23/01 19:37	16	0.91	6	110
4	1/23/01 20:25	16	0.70	25	130
4	1/23/01 21:12	14	0.64	18	110
4	1/23/01 22:14	15	0.96	17	110
4	1/23/01 23:01	15	0.57	17	110
4	1/24/01 0:50	14	0.73	19	120
4	1/24/01 1:37	23	0.75	19	120
4	1/24/01 2:39	16	0.65	19	120
4	1/24/01 2:39	16	0.71	19	120
4	1/24/01 3:25	13	0.96	20	140
4	1/24/01 4:26	16	0.77	19	130
4	1/24/01 5:12	15	0.71	16	140
4	1/24/01 5:58	16	0.79	18	150
4	1/24/01 6:59	14	0.98	17	140
4	1/24/01 7:46	15	0.93	17	140

Dry Dock	Logged Date	TSS (mg/L)	Turbidity (NTU)	Copper (ppb)	Zinc (ppb)
4	1/24/01 15:42	14	0.66	27	240
4	1/24/01 16:44	16	0.77	25	240
4	1/24/01 17:31	14	0.67	26	240
4	1/24/01 18:19	14	0.63	24	230
4	1/24/01 19:22	13	0.98	22	230
4	1/24/01 20:10	17	0.68	23	230
4	1/24/01 21:12	28	0.71	23	230
4	1/24/01 22:00	16	0.61	24	240
4	1/24/01 23:03	15	0.76	23	230
4	1/24/01 23:50	14	0.82	21	230
4	1/25/01 0:53	16	0.98	19	230
4	1/25/01 1:41	15	0.63	19	240
4	1/25/01 2:43	14	0.68	23	230
4	1/25/01 3:31	16	0.54	23	230
4	1/25/01 3:32	17	0.67	23	240
4	1/25/01 4:33	16	1.20	24	250
4	1/25/01 5:20	15	0.57	23	250
4	1/25/01 6:08	14	0.94	23	270
4	1/25/01 7:09	14	0.56	23	250
4	1/25/01 7:57	14	1.00	25	260
4	1/25/01 8:58	13	0.59	23	260
4	1/25/01 9:45	14	0.47	22	280
4	1/25/01 10:32	14	0.54	24	250
4	1/25/01 11:32	14	0.73	28	240
4	1/25/01 22:02	17	0.65	17	170
4	1/30/01 12:18	11	1.10	64	240
4	1/30/01 13:06	12	0.81	38	200
4	1/30/01 14:09	12	1.20		210
4	1/30/01 14:56	10	0.82		200
4	1/30/01 15:59	1	0.56		210
4	1/30/01 16:00	12	0.66		220
4	1/30/01 16:00	12	0.93		210
4	1/30/01 16:47	12	0.89		210
4	1/30/01 17:35	10	0.44		210
4	1/30/01 18:36	11	0.55		210
4	1/30/01 18:36	13	0.60		200
4	1/30/01 19:24	12	0.46		200
4	1/30/01 20:11	13	0.42		200
4	1/30/01 21:13	12	0.59		200
4	1/30/01 22:00	13	0.54		190
4	1/30/01 23:02	13	0.53		180
4	1/30/01 23:49	14	0.50		170
4	1/31/01 0:51	12	0.61		180
4	1/31/01 0:51	12	0.62		200
4	1/31/01 1:38	12	0.71		190
4	1/31/01 2:40	12	0.53		190
4	1/31/01 3:27	13	0.43		180
4	1/31/01 4:14	11	0.50		180
4	1/31/01 5:16	10	0.47		170
4	1/31/01 6:03	12	0.74		170
4	1/31/01 7:05	11	0.79		160
4	1/31/01 12:21	11	0.61		190
4	1/31/01 13:09	12	0.63		230
4	1/31/01 14:11	10	0.52		180
4	1/31/01 14:12	12	0.62		170
4	1/31/01 14:12	11	0.62		170
4	1/31/01 14:59	14	0.55		160
4	1/31/01 14:59	11	0.58		160
4	1/31/01 15:00	14	0.58		150
4	1/31/01 15:46	12	0.57	25	200
4	1/31/01 16:48	14	0.62	3	250
4	1/31/01 16:48	12	0.63	7	270
4	1/31/01 17:36	13	0.50		250
4	1/31/01 18:37	12	0.57	2	240
4	1/31/01 19:25	13	0.51		240
4	1/31/01 19:25	13	0.58	2	240

Dry Dock	Logged Date	TSS (mg/L)	Turbidity (NTU)	Copper (ppb)	Zinc (ppb)
4	1/31/01 20:12	12	0.86		240
4	1/31/01 21:13	12	0.54	2	230
4	1/31/01 21:59	12	0.64	45	300
4	1/31/01 22:00	12	0.45	32	210
4	1/31/01 22:46	13	0.42	26	160
4	1/31/01 23:47	11	0.46	32	140
4	2/1/01 0:49	11	0.47	35	150
4	2/1/01 1:36	11	0.40	34	140
4	2/1/01 1:36	11	0.41	25	160
4	2/1/01 2:37	13	0.43	25	100
4	2/1/01 2:38	14	0.47	27	
4	2/5/01 12:04	12	0.72	27	210
4	2/5/01 12:48	12	0.65	23	200
4	2/5/01 13:31	13	0.54	22	200
4	2/5/01 13:32	13	0.51	23	210
4	2/5/01 14:28	12	0.55	23	210
4	2/5/01 14:28	12	0.56	22	210
4	2/5/01 15:12	15	1.20	28	210
4	2/5/01 15:12	12	1.20	30	210
4	2/5/01 16:23	13	0.61	23	200
4	2/5/01 17:07	14	0.45	23	200
4	2/5/01 17:07	13	0.54	23	210
4	2/5/01 18:04	13	0.50	23	200
4	2/5/01 18:04	14	0.68	20	190
4	2/5/01 18:48	14	0.55	21	190
4	2/5/01 19:32	11	0.86	21	200
4	2/5/01 20:29	13	0.46	21	200
4	2/5/01 21:12	13	0.65	23	210
4	2/5/01 21:56	13	0.44	21	210
4	2/5/01 21:56	13	0.45	23	220
4	2/5/01 22:53	13	0.48	22	200
4	2/5/01 22:54	12	0.74	22	200
4	2/5/01 23:37	12	0.64	22	210
4	2/6/01 0:48	12	0.61	23	200
4	2/6/01 1:32	12	0.47	21	200
4	2/6/01 1:33	10	0.50	22	200
4	2/6/01 10:52	10	0.84	22	200
4	2/6/01 11:35	12	0.92	22	200
4	2/6/01 12:32	13	0.58	23	200
4	2/6/01 12:33	11	0.67	23	200
4	2/6/01 13:17	4	0.63	22	200
4	2/6/01 14:16	10	1.40	26	200
4	2/6/01 15:04	10	1.40	27	220
4	2/6/01 15:54	12	1.10	26	220
4	2/6/01 15:54	14	1.10	27	230
4	2/6/01 16:59	14	1.20	26	220
4	2/6/01 16:59	14	1.20	27	220
4	2/6/01 17:49	15	1.00	26	220
4	2/6/01 18:53	14	0.94	23	210
4	2/6/01 19:43	2	0.85	23	210
4	2/6/01 20:47	14	0.92	22	200
4	2/6/01 21:37	15	1.20	21	210
4	2/6/01 22:40	14	1.50	26	210
4	2/6/01 23:28	14	1.00	24	220
4	2/7/01 1:01	14	0.79	21	200
4	2/7/01 1:47	10	0.58	22	200
4	2/7/01 1:47	4	0.58	23	210
4	2/7/01 2:47	10	0.63	21	210
4	2/7/01 3:33	11	0.45	14	180
4	2/7/01 4:34	2	0.56	16	200
4	2/7/01 5:20	11	0.49	17	200
4	2/7/01 5:20	12	0.54	19	200
4	2/7/01 10:23	9	0.68	22	190
4	2/7/01 11:22	11	0.46	23	200
4	2/7/01 12:06	9	0.45	24	200
4	2/7/01 12:06	12	0.67	25	200

Dry Dock	Logged Date	TSS (mg/L)	Turbidity (NTU)	Copper (ppb)	Zinc (ppb)
4	2/7/01 12:07	11	0.62	23	190
4	2/7/01 13:04	15	0.64	24	200
4	2/7/01 13:48	13	0.65	29	200
4	2/7/01 14:46	13	0.78	27	200
4	2/7/01 15:31	13	0.45	24	200
4	2/7/01 16:17	11	0.65	25	200
4	2/7/01 17:16	13	0.41	22	190
4	2/7/01 17:16	13	0.48	21	190
4	2/7/01 18:01	11	0.45	23	200
4	2/7/01 19:00	10	0.37	22	190
4	2/7/01 19:01	10	0.45	21	190
4	2/7/01 19:01	10	0.48	23	190
4	2/7/01 19:46	7	0.38	21	190
4	2/7/01 19:46	10	0.44	22	190
4	2/7/01 20:30	10	0.36	21	190
4	2/7/01 21:28	12	0.45	22	200
4	2/7/01 21:28	12	0.46	21	200
4	2/7/01 22:13	13	0.37	21	190
4	2/7/01 23:11	11	0.34	23	210
4	2/7/01 23:11	7	0.44	21	190
4	2/7/01 23:55	11	0.48	23	200
4	2/7/01 23:56	11	0.37	24	200
4	2/12/01 14:16	14	0.74	31	230
4	2/12/01 15:25	14	0.33	29	220
4	2/12/01 16:21	14	0.59	27	220
4	2/12/01 17:16	14	0.63	28	210
4	2/12/01 17:17	13	0.51	27	210
4	2/12/01 17:17	14	0.54	26	200
4	2/12/01 17:18	15	0.56	27	210
4	2/12/01 17:18	14	0.62	26	210
4	2/12/01 17:19	12	0.53	27	210
4	2/12/01 18:28	13	0.57	26	230
4	2/12/01 19:24	15	0.56	27	220
4	2/12/01 19:24	13	0.58	27	210
4	2/12/01 19:25	15	0.52	27	210
4	2/12/01 20:37	15	0.50	26	230
4	2/12/01 20:38	15	0.57	27	230
4	2/12/01 20:38	14	0.57	28	240
4	2/12/01 20:38	15	0.61	27	230
4	2/12/01 21:33	15	0.40	27	230
4	2/12/01 22:46	10	0.51	27	230
4	2/12/01 23:42	13	0.45	28	240
4	2/13/01 1:09	13	0.42	28	240
4	2/13/01 2:21	14	0.52	26	240
4	2/13/01 3:17	14	0.47	23	230
4	2/13/01 4:29	14	0.63	23	280
4	2/13/01 4:29	16	0.71	22	210
4	2/13/01 5:24	14	0.66	26	230
4	2/13/01 11:46	15	0.86	26	210
4	2/13/01 12:59	12	0.56	6	57
4	2/13/01 13:56	15	0.79	8	33
4	2/13/01 15:13	14	0.59	29	220
4	2/13/01 15:13	16	0.81	28	210
4	2/13/01 16:11	13	0.71	28	210
4	2/13/01 16:11	17	0.72	28	210
4	2/13/01 17:28	17	0.43	28	200
4	2/13/01 17:28	17	0.43	28	230
4	2/13/01 17:28	17	0.43	30	200
4	2/13/01 17:28	17	0.43	30	230
4	2/13/01 17:28	17	0.63	28	200
4	2/13/01 17:28	17	0.63	28	230
4	2/13/01 17:28	17	0.63	30	200
4	2/13/01 17:28	17	0.63	30	230
4	2/13/01 18:26	13	0.62	26	210
4	2/13/01 19:42	13	0.48	29	220
4	2/13/01 20:39	12	0.52	28	220

Dry Dock	Logged Date	TSS (mg/L)	Turbidity (NTU)	Copper (ppb)	Zinc (ppb)
4	2/13/01 20:39	13	0.53	30	220
4	2/13/01 21:54	14	0.63	30	220
4	2/13/01 22:52	13	0.58	30	220
4	2/14/01 1:01	13	0.54	31	220
4	2/14/01 1:57	13	0.78	33	220
4	2/14/01 3:11	13	0.59	30	220
4	2/14/01 4:24	13	0.53	30	220
4	2/14/01 5:20	13	0.43	28	200
4	2/14/01 5:20	13	0.43	28	230
4	2/14/01 5:20	13	0.43	30	200
4	2/14/01 5:20	13	0.43	30	230
4	2/14/01 5:20	13	0.63	28	200
4	2/14/01 5:20	13	0.63	28	230
4	2/14/01 5:20	13	0.63	30	200
4	2/14/01 5:20	13	0.63	30	230
4	2/14/01 6:17	13	0.45	28	220
4	2/14/01 6:17	12	0.46	29	220
4	2/14/01 7:28	12	0.45	29	220
4	2/14/01 8:38	11	0.46	27	210
4	2/14/01 9:30	11	0.48	28	210
4	2/14/01 10:23	11	0.44	26	210
4	2/14/01 11:39	1	0.54	29	210
4	2/14/01 12:32	10	0.45	29	210
4	2/14/01 12:32	11	0.46	27	200
4	2/14/01 13:42	11	0.52	26	200
4	2/14/01 14:35	12	0.53	27	200
4	2/14/01 15:45	12	0.72	29	200
4	2/14/01 15:45	11	1.90	29	200
4	2/14/01 16:38	12	0.57	28	200
4	2/14/01 17:48	13	0.65	27	200
4	2/14/01 18:42	11	0.52	29	200
4	2/14/01 19:51	11	0.56	28	200
4	2/14/01 20:45	15	0.46	27	200
4	2/14/01 21:55	13	0.57	27	210
4	2/14/01 22:48	14	0.44	27	210
4	2/14/01 22:48	14	0.45	25	200
4	2/14/01 23:41	13	0.49	28	210
4	2/15/01 1:08	14	0.50	26	200
4	2/15/01 2:02	12	0.38	25	200
4	2/15/01 3:12	5	0.70	26	200
4	2/15/01 4:05	11	0.38	26	210
4	2/15/01 5:10	13	1.60	40	320
4	2/15/01 5:39	16	6.80	140	530
4	2/15/01 6:09	7	5.30	160	580
4	2/15/01 6:47	10	5.20	130	540
4	2/15/01 6:48	12	5.70	130	530
4	2/15/01 7:33	11	4.00	120	460
4	2/19/01 13:04	12	0.42	25	210
4	2/19/01 13:58	13	0.40	24	210
4	2/19/01 15:07	20	0.45	25	200
4	2/19/01 16:01	14	0.36	25	200
4	2/19/01 17:10	12	0.31	23	200
4	2/19/01 18:04	13	0.35	23	200
4	2/19/01 19:13	12	0.42	23	200
4	2/19/01 20:06	3	0.30	23	200
4	2/19/01 20:59	11	0.36	23	200
4	2/19/01 22:08	13	0.39	24	200
4	2/19/01 23:01	10	0.32	23	190
4	2/20/01 1:01	12	0.29	24	200
4	2/20/01 1:54	9	0.32	23	200
4	2/20/01 3:02	9	0.32	22	190
4	2/20/01 3:55	11	0.31	21	200
4	2/20/01 5:03	10	0.45	22	200
4	2/20/01 5:55	9	0.27	22	200
4	2/20/01 7:04	9	0.34	21	190
4	2/20/01 7:57	11	0.30	21	190

Dry Dock	Logged Date	TSS (mg/L)	Turbidity (NTU)	Copper (ppb)	Zinc (ppb)
4	2/20/01 8:57	11	0.48	20	190
4	2/20/01 10:07	10	0.38	20	190
4	2/20/01 10:07	8	0.42	22	190
4	2/20/01 11:00	11	0.42	22	190
4	2/20/01 11:00	10	0.44	21	250
4	2/20/01 12:09	10	0.89	22	190
4	2/20/01 13:02	1	0.68	21	190
4	2/20/01 14:11	9	0.52	21	180
4	2/20/01 15:05	10	0.41	18	180
4	2/20/01 16:15	11	0.89	20	180
4	2/20/01 17:09	13	0.54	20	180
4	2/20/01 17:09	12	0.58	21	180
4	2/20/01 18:19	12	0.43	21	190
4	2/20/01 18:19	13	0.49	21	190
4	2/20/01 19:12	10	0.51	21	190
4	2/20/01 19:13	12	0.46	21	180
4	2/20/01 20:23	12	0.46	21	190
4	2/20/01 20:23	11	0.47	19	190
4	2/20/01 21:16	13	0.42	20	190
4	2/20/01 22:26	12	0.43	20	190
4	2/20/01 23:19	11	0.43	18	180
4	2/21/01 1:04	11	0.43	20	180
4	2/21/01 1:57	11	0.43	20	190
4	2/21/01 3:06	13	0.53	20	190
4	2/21/01 4:00	13	0.42	19	190
4	2/21/01 5:09	13	0.42	18	180
4	2/21/01 6:02	13	0.34	23	200
4	2/21/01 6:02	12	0.36	21	200
4	2/21/01 7:11	12	0.39	22	200
4	2/21/01 8:04	14	0.45	19	190
4	2/21/01 8:05	12	0.39	21	190
4	2/21/01 10:42	9	0.91	24	190
4	2/21/01 11:51	10	1.10	26	200
4	2/21/01 12:43	9	1.20	27	200
4	2/21/01 13:51	9	1.10	24	190
4	2/21/01 14:45	3	0.77	24	200
4	2/21/01 15:55	8	0.90	26	200
4	2/21/01 16:40	12	2.30	45	310
4	2/21/01 17:19	12	3.10	60	340
4	2/21/01 18:15	13	3.00	57	330
4	2/21/01 19:04	12	2.30	58	300
4	2/21/01 20:09	13	0.50	46	260
4	2/21/01 21:01	12	0.99	39	240
4	2/21/01 22:09	13	0.99	34	220
4	2/21/01 23:01	11	0.74	30	210
4	2/21/01 23:01	12	0.78	30	210
4	2/22/01 1:03	11	0.82	26	210
4	2/22/01 1:03	12	0.83	26	210
4	2/22/01 1:57	13	0.61	26	200
4	2/22/01 3:06	12	0.80	24	200
4	2/22/01 3:59	12	0.57	22	190
4	2/22/01 5:09	12	0.42	21	190
4	2/22/01 5:09	13	0.44	21	190
4	2/22/01 6:01	13	0.53	21	190
4	2/22/01 7:10	13	0.50	22	190
4	2/22/01 8:03	12	0.56	21	190
4	2/22/01 8:04	13	0.50	23	200
4	2/26/01 11:04	11	0.93	36	160
4	2/26/01 12:18	12	1.10	38	150
4	2/26/01 13:12	11	1.20	39	150
4	2/26/01 14:21	10	0.88	37	140
4	2/26/01 15:14	9	0.76	32	130
4	2/26/01 16:25	10	1.40	38	130
4	2/26/01 17:22	11	0.89	33	130
4	2/26/01 18:36	10	0.87	33	130
4	2/26/01 19:33	9	0.66	30	130

Dry Dock	Logged Date	TSS (mg/L)	Turbidity (NTU)	Copper (ppb)	Zinc (ppb)
4	2/26/01 20:47	8	0.85	36	130
4	2/26/01 20:47	9	0.87	36	130
4	2/26/01 21:43	10	0.36	33	130
4	2/26/01 21:43	11	0.55	34	140
4	2/26/01 22:57	11	1.40	39	150
4	2/27/01 1:06	2	0.96	33	150
4	2/27/01 2:19	11	0.96	34	150
4	2/27/01 3:14	12	0.83	32	150
4	2/27/01 4:27	11	0.75	34	160
4	2/27/01 5:23	10	0.48	30	150
4	2/27/01 6:36	10	1.00	35	180
4	2/27/01 7:30	10	0.62	31	170
4	2/27/01 8:39	10	0.63	32	160
4	2/27/01 9:33	9	0.47	30	170
4	2/27/01 9:34	10	0.53	30	150
4	2/27/01 10:46	10	0.81	32	160
4	2/27/01 11:41	10	0.62	33	150
4	2/27/01 12:52	9	0.77	26	130
4	2/27/01 13:46	10	0.68	22	160
4	2/27/01 14:57	9	0.38	22	180
4	2/27/01 15:51	9	0.50	21	180
4	2/27/01 17:00	9	0.46	22	190
4	2/27/01 18:09	10	0.53	22	200
4	2/27/01 19:02	8	0.34	21	200
4	2/27/01 20:11	8	0.34	21	200
4	2/27/01 21:20	11	0.40	20	200
4	2/27/01 22:12	10	0.31	21	210
4	2/27/01 23:21	10	0.36	21	220
4	2/28/01 2:14	9	0.33	20	210
4	2/28/01 3:06	10	0.35	25	120
4	2/28/01 4:14	9	0.34	26	120
4	2/28/01 5:23	9	0.41	26	120
4	2/28/01 6:15	11	0.41	26	130
4	2/28/01 7:24	11	0.38	30	140
4	2/28/01 8:16	10	0.35	29	140
4	2/28/01 8:16	11	0.37	30	150
4	3/1/01 3:01	13	1.00	32	530
4	3/1/01 3:48	15	0.53	31	570
4	3/1/01 3:48	15	0.55	28	580
4	3/1/01 4:49	16	0.72	27	530
4	3/1/01 5:37	16	0.68	30	540
4	3/1/01 6:38	15	0.67	27	390
4	3/1/01 7:25	17	0.53	27	520
4	3/1/01 8:26	17	0.85	26	530
4	3/1/01 9:13	16	0.91	28	420
4	3/1/01 10:14	17	1.70	30	510
4	3/1/01 10:59	18	0.98	44	620
4	3/1/01 11:42	23	5.60	170	1000
4	3/1/01 12:08	27	12.00	260	1100
4	3/1/01 12:25	31	18.00	370	1300
4	3/1/01 12:41	30	20.00	370	1200
4	3/1/01 12:41	31	20.00	370	1200
4	3/20/01 15:17	38	8.40	170	350
4	3/20/01 15:32	23	9.00	110	230
4	3/20/01 15:59	18	2.20	69	270
4	3/20/01 16:36	13	1.70	63	160
4	3/20/01 16:36	11	1.90	63	160
4	3/20/01 17:34	14	1.80	56	130
4	3/20/01 18:23	13	1.00	46	120
4	3/20/01 19:27	14	1.10	39	88
4	3/20/01 20:16	15	1.00	43	91
4	3/20/01 20:16	13	1.20	41	89
4	3/20/01 20:16	14	1.20	42	91
4	3/20/01 21:20	13	0.79	35	82
4	3/20/01 21:20	13	0.96	37	95
4	3/20/01 22:09	13	1.40	41	120

Dry Dock	Logged Date	TSS (mg/L)	Turbidity (NTU)	Copper (ppb)	Zinc (ppb)
4	3/20/01 23:13	14	0.75	37	110
4	3/21/01 0:48	16	0.68	34	89
4	3/21/01 0:49	16	0.61	33	100
4	3/21/01 1:52	16	0.72	33	98
4	3/21/01 2:41	15	0.59	35	81
4	3/21/01 3:44	14	0.63	30	74
4	3/21/01 4:32	15	0.65	34	77
4	3/21/01 4:33	17	0.56	30	72
4	3/21/01 4:33	15	0.58	31	73
4	3/21/01 5:35	15	0.62	29	81
4	3/21/01 6:24	15	0.57	30	71
4	3/21/01 7:27	17	0.60	30	71
4	3/21/01 13:07	10	0.88	38	88
4	3/21/01 14:11	9	0.79	42	120
4	3/21/01 15:15	10	0.99	40	110
4	3/21/01 16:04	10	0.78	39	83
4	3/21/01 17:08	12	0.81	39	84
4	3/21/01 17:57	10	0.60	34	84
4	3/21/01 17:57	9	0.61	34	86
4	3/21/01 17:58	10	0.59	35	82
4	3/21/01 19:00	12	0.69	39	90
4	3/21/01 19:00	10	0.70	38	90
4	3/21/01 19:48	10	0.57	40	97
4	3/21/01 20:50	12	0.58	37	97
4	3/21/01 21:38	11	0.65	36	110
4	3/21/01 22:41	2	0.48	36	89
4	3/21/01 23:29	8	0.53	35	90
4	3/22/01 0:53	10	0.69	37	90
4	3/22/01 1:55	10	0.82	36	130
4	3/22/01 2:42	8	0.60	34	92
4	3/22/01 3:44	9	0.50	42	99
4	3/22/01 3:44	13	0.53	30	87
4	3/22/01 4:31	13	0.48	32	89
4	3/22/01 5:33	13	0.46	28	85
4	3/22/01 6:20	9	0.43	29	89
4	3/22/01 7:19	9	0.42	28	93
4	3/22/01 8:04	9	0.51	27	84
4	3/26/01 11:56	16	1.10	36	160
4	3/26/01 12:30	16	0.81	28	140
4	3/26/01 13:15	3	1.10	29	140
4	3/26/01 13:49	15	1.60	25	120
4	3/26/01 14:23	15	1.20	24	110
4	3/26/01 14:57	17	1.50	26	130
4	3/26/01 15:20	14	6.10	77	180
4	3/26/01 15:43	16	7.20	78	170
4	3/26/01 16:01	15	8.90	67	170
4	3/26/01 16:02	15	8.30	65	170
4	3/26/01 17:01	15	6.00	100	280
4	3/26/01 17:34	19	3.50	67	180
4	3/26/01 18:07	16	2.00	44	150
4	3/26/01 19:25	17	1.20	30	130
4	3/26/01 19:25	17	1.20	32	140
4	3/26/01 19:26	16	1.20	31	140
4	3/26/01 20:00	18	0.97	29	130
4	3/26/01 20:34	16	0.83	24	120
4	3/26/01 21:18	16	0.81	25	130
4	3/26/01 21:52	17	0.93	25	130
4	3/26/01 21:52	18	0.94	21	120
4	3/26/01 22:26	16	0.81	33	140
4	3/26/01 23:00	17	0.59	31	140
4	3/26/01 23:34	16	0.69	30	140
4	3/27/01 12:42	13	8.80	160	310
4	3/27/01 13:07	6	9.10	160	330
4	3/27/01 13:23	16	8.40	150	360
4	3/27/01 13:23	13	10.00	160	340
4	3/27/01 13:37	18	13.00	180	400

Dry Dock	Logged Date	TSS (mg/L)	Turbidity (NTU)	Copper (ppb)	Zinc (ppb)
4	3/27/01 13:50	19	14.00	220	410
4	3/27/01 13:50	17	15.00	220	400
4	3/27/01 14:02	19	16.00	270	500
4	3/27/01 14:02	17	16.00	270	510
4	3/27/01 14:13	20	19.00	300	550
4	3/27/01 14:21	24	21.00	350	600
4	3/27/01 14:32	25	20.00	370	620
4	3/27/01 14:43	23	18.00	430	690
4	3/27/01 14:50	23	28.00		
4	3/27/01 15:09	20	23.00	370	630
4	3/27/01 15:21	19	24.00	310	600
4	3/27/01 15:32	14	21.00	280	560
4	3/27/01 15:44	14	18.00	260	520
4	3/27/01 16:01	14	14.00	240	510
4	3/27/01 16:01	13	17.00	250	490
4	3/27/01 16:13	13	18.00	220	470
4	3/27/01 16:26	12	12.00	190	440
4	3/27/01 16:39	11	10.00	170	420
4	3/27/01 16:58	11	7.80	130	350
4	3/27/01 17:13	10	9.20		350
4	3/28/01 12:06	13	0.90	36	150
4	3/28/01 12:43	11	0.60	33	130
4	3/28/01 13:31	13	0.90	32	140
4	3/28/01 14:07	15	1.30	41	150
4	3/28/01 14:54	13	1.10	37	140
4	3/28/01 15:29	13	1.80	51	160
4	3/28/01 16:02	9	1.80	69	200
4	3/28/01 16:36	10	1.90	60	200
4	3/28/01 17:15	12	2.40	87	230
4	3/28/01 17:48	11	2.10	68	190
4	3/28/01 17:48	12	2.20	61	190
4	3/28/01 18:32	15	1.80	48	200
4	3/28/01 19:08	14	1.80	41	180
4	3/28/01 19:44	13	1.70	52	200
4	3/28/01 20:32	12	1.60	41	150
4	3/28/01 21:09	13	1.00	40	150
4	3/28/01 21:46	12	0.90	38	140
4	3/28/01 22:34	12	0.90	34	130
4	3/28/01 23:11	14	1.50	31	130
4	3/28/01 23:48	13	0.70	33	140
4	3/29/01 0:48	12	0.70	33	140
4	3/29/01 0:48	15	0.70	34	140
4	3/29/01 1:25	13	1.50	32	150
4	3/29/01 2:02	15	0.90	32	130
4	3/29/01 2:50	14	0.80	32	140
4	3/29/01 3:27	12	1.10	25	130
5	3/12/01 16:15	8	1.60	70	460
5	3/12/01 17:06	10	1.60	71	400
5	3/12/01 17:57	7	1.50	64	380
5	3/12/01 18:48	8	1.40	60	360
5	3/12/01 19:39	10	1.70	60	330
5	3/12/01 21:18	9	1.20	54	290
5	3/12/01 22:10	11	1.20	50	270
5	3/12/01 23:02	10	1.10	46	250
5	3/12/01 23:54	10	1.40	44	240
5	3/13/01 0:46	10	0.87	47	230
5	3/13/01 2:29	12	1.30	65	270
5	3/13/01 3:22	12	1.50	73	260
5	3/13/01 4:13	11	1.30	69	240
5	3/13/01 5:05	11	1.40	65	240
5	3/13/01 5:55	11	1.10	59	230
5	3/13/01 7:32	12	1.20	58	240
5	3/13/01 8:22	9	1.10	56	240
5	3/13/01 9:06	1	1.20	58	240
5	3/13/01 9:46	10	1.20	59	250
5	3/13/01 10:33	9	1.20	61	230

Dry Dock	Logged Date	TSS (mg/L)	Turbidity (NTU)	Copper (ppb)	Zinc (ppb)
5	3/13/01 10:33	8	1.20	64	250
5	3/13/01 11:19	9	1.70	66	250
5	3/13/01 11:19	9	1.70	66	250
5	3/13/01 12:56	8	2.90	83	290
5	3/13/01 13:48	10	3.40	91	310
5	3/13/01 14:39	10	3.30	97	320
5	3/13/01 15:32	9	3.70	110	330
5	3/13/01 16:26	9	3.10	110	320
5	3/13/01 18:11	8	3.20	91	310
5	3/13/01 18:12	10	2.60	93	310
5	3/13/01 18:12	10	2.70	91	320
5	3/13/01 19:03	9	2.30	82	280
5	3/13/01 19:56	10	1.90	71	270
5	3/13/01 20:48	8	1.60	66	250
5	3/13/01 21:40	9	1.50	64	250
5	3/13/01 22:33	10	1.20	60	230
5	3/13/01 22:33	10	1.20	61	230
5	3/14/01 0:16	10	1.10	55	220
5	3/14/01 1:09	9	0.97	52	220
5	3/14/01 2:02	9	0.87	50	210
5	3/14/01 2:55	9	0.93	50	210
5	3/14/01 3:48	9	0.71	46	210
5	3/14/01 4:41	8	0.94	46	200
5	3/14/01 6:23	9	0.77	46	200
5	3/14/01 6:23	9	0.87	46	200
5	3/14/01 7:14	10	0.63	45	210
5	3/14/01 8:05	10	0.83	46	220
5	3/14/01 8:56	10	0.66	42	220
5	3/14/01 9:47	10	0.67	45	220
5	3/14/01 11:25	8	0.81	49	190
5	3/14/01 12:19	8	2.30	49	190
5	3/14/01 13:13	7	1.00	53	180
5	3/14/01 14:08	10	1.20	53	180
5	3/14/01 15:04	12	1.30	54	180
5	3/14/01 15:04	11	1.30	55	180
5	3/14/01 15:59	13	1.20	53	180
5	3/14/01 15:59	9	1.20	53	180
5	3/14/01 17:45	10	1.60	56	180
5	3/14/01 18:38	12	1.50	58	180
5	3/14/01 19:30	11	1.60	58	180
5	3/14/01 20:23	12	1.50	56	170
5	3/14/01 21:15	12	1.20	55	170
5	3/14/01 22:07	11	1.10	53	170
5	3/14/01 23:50	12	0.99	51	180
5	3/15/01 0:43	11	0.85	48	170
5	3/15/01 1:35	12	0.88	48	170
5	3/15/01 2:28	12	0.66	46	170
5	3/15/01 3:22	9	0.73	47	170
5	3/15/01 5:04	12	0.61	49	180
5	3/15/01 5:51	12	0.72	51	180
5	3/15/01 6:34	11	0.82	55	190
5	3/15/01 7:12	12	1.20	71	260
5	3/15/01 7:45	12	1.70	110	370
5	3/15/01 8:14	13	2.90	150	500
5	3/15/01 9:52	14	4.90	220	630
5	3/19/01 9:50	7	2.00	60	190
5	3/19/01 10:40	8	0.99	52	180
5	3/19/01 11:29	7	1.00	49	170
5	3/19/01 15:13	8	1.60	61	350
5	3/19/01 15:15	8	1.90	56	310
5	3/19/01 15:19	9	2.30	65	460
5	3/19/01 15:30	9	3.80	75	490
5	3/19/01 16:28	9	5.50	91	520
5	3/19/01 17:10	10	4.70	86	490
5	3/19/01 17:56	10	3.60	84	470
5	3/19/01 18:46	3	3.60	95	500

Dry Dock	Logged Date	TSS (mg/L)	Turbidity (NTU)	Copper (ppb)	Zinc (ppb)
5	3/19/01 19:37	7	2.80	96	260
5	3/19/01 21:20	9	2.60	94	260
5	3/19/01 22:12	8	2.50	87	250
5	3/19/01 23:04	9	2.50	81	240
5	3/19/01 23:56	10	1.70	70	220
5	3/20/01 0:47	10	1.40	61	210
5	3/20/01 2:27	10	1.30	56	200
5	3/20/01 3:17	9	1.10	52	210
5	3/20/01 4:08	8	1.40	48	180
5	3/20/01 4:58	9	1.20	37	370
5	3/20/01 5:49	9	0.91	28	330
5	3/20/01 6:40	8	0.89	31	310
5	3/20/01 8:21	10	0.92	24	290
5	3/20/01 13:27	11	1.50	55	140
5	3/20/01 14:20	14	1.70	47	160
5	3/20/01 15:13	13	2.10	45	130
5	3/20/01 16:06	10	2.00	43	130
5	3/20/01 17:00	10	2.20	44	140
5	3/20/01 17:55	9	1.80	52	160
5	3/20/01 19:42	9	1.70	47	160
5	3/20/01 20:38	8	1.60	45	150
5	3/20/01 21:34	8	1.50	41	150
5	3/20/01 22:29	9	1.10	38	140
5	3/20/01 22:29	10	1.10	39	140
5	3/20/01 23:23	11	1.10	36	150
5	3/21/01 1:09	10	1.10	39	170
5	3/21/01 2:02	11	0.96	44	260
5	3/21/01 2:54	12	0.85	42	220
5	3/21/01 3:47	12	0.94	41	200
5	3/21/01 4:39	10	0.70	38	180
5	3/21/01 6:22	10	0.88	38	180
5	3/21/01 7:16	9	0.83	37	180
5	3/21/01 8:10	20	0.88	36	160
5	3/21/01 13:36	8	1.10	38	170
5	3/21/01 14:30	9	0.93	37	180
5	3/21/01 15:22	8	1.10	37	170
5	3/21/01 16:13	9	1.40	35	170
5	3/21/01 17:05	11	1.80	40	180
5	3/21/01 18:46	11	1.60	40	170
5	3/21/01 19:38	11	1.50	35	160
5	3/21/01 20:30	11	1.40	35	160
5	3/21/01 21:22	10	1.40	36	160
5	3/21/01 21:22	11	1.40	44	190
5	3/21/01 22:14	9	1.40	55	180
5	3/21/01 23:54	9	1.60	51	210
5	3/22/01 0:44	11	1.50	47	170
5	3/22/01 0:44	10	1.50	49	190
5	3/22/01 1:34	10	1.30	43	190
5	3/22/01 2:23	9	1.00	43	170
5	3/22/01 3:12	9	0.85	38	190
5	3/22/01 4:01	10	0.84	38	160
5	3/22/01 5:37	9	0.81	39	170
5	3/22/01 5:38	8	0.96	40	170
5	3/22/01 6:26	10	0.73	40	160
5	3/22/01 7:16	11	0.81	37	160
5	3/22/01 8:06	11	0.72	36	160
5	3/22/01 8:55	10	0.92	41	160
5	3/26/01 12:29	14	7.60	190	550
5	3/26/01 14:01	12	5.80	160	500
5	3/26/01 15:13	13	5.20	150	470
5	3/26/01 15:29	5	9.70	220	550
5	3/26/01 16:07	12	19.00	510	830
5	3/26/01 16:37	19	23.00	500	820
5	3/26/01 16:37	21	24.00	500	800
5	3/26/01 17:17	17	15.00	420	750
5	3/26/01 17:17	20	17.00	420	750

Dry Dock	Logged Date	TSS (mg/L)	Turbidity (NTU)	Copper (ppb)	Zinc (ppb)
5	3/26/01 18:09	17	19.00	340	660
5	3/26/01 19:11	4	14.00	280	610
5	3/26/01 21:48	12	11.00	230	570
5	3/26/01 23:17	14	8.90	200	530
5	3/27/01 0:50	17	7.40	180	500
5	3/27/01 2:24	18	6.60	160	480
5	3/27/01 5:25	18	5.20	140	470
5	3/27/01 6:53	19	4.20	120	460
5	3/27/01 8:23	18	3.20	110	430
5	3/27/01 9:54	19	2.70	100	440
5	3/27/01 11:43	20	3.80	110	420
5	3/27/01 12:05	19	7.30	160	500
5	3/27/01 12:22	16	13.00	230	640
5	3/27/01 12:35	20	22.00	330	810
5	3/27/01 13:04	21	27.00	580	880
5	3/27/01 13:18	18	27.00	400	860
5	3/27/01 13:19	20	28.00	420	890
5	3/27/01 13:19	17	28.00	430	880
5	3/27/01 13:29	20	28.00	440	890
5	3/27/01 13:38	19	26.00	450	910
5	3/27/01 13:46	19	28.00	540	1000
5	3/27/01 13:53	27	39.00	580	1000
5	3/27/01 14:00	22	34.00	640	1100
5	3/27/01 14:08	30	41.00	700	1100
5	3/27/01 14:08	26	43.00	740	1100
5	3/27/01 14:17	26	34.00	680	1100
5	3/27/01 14:25	33	41.00	690	1100
5	3/27/01 14:33	33	38.00	760	1100
5	3/27/01 14:42	30	48.00	740	1100
5	3/27/01 14:45	31	47.00	790	1100
5	3/27/01 14:47	31	47.00	750	1100
5	3/27/01 14:52	24	43.00	720	1000
5	3/27/01 14:52	28	43.00	760	1100
5	3/27/01 14:57	26	44.00	730	1000
5	3/27/01 14:57	29	47.00	720	1000
5	3/27/01 15:02	25	42.00	730	1000
5	3/27/01 15:07	24	39.00	700	990
5	3/27/01 15:12	30	32.00	710	1000
5	3/27/01 15:18	23	34.00	680	960
5	3/28/01 12:26	11	2.60	120	520
5	3/28/01 13:53	12	2.20	50	240
5	3/28/01 15:15	12	2.90	61	420
5	3/28/01 16:08	12	3.20	77	260
5	3/28/01 17:37	13	7.30	160	520
5	3/28/01 18:21	11	10.00	190	580
5	3/28/01 19:04	11	10.00	170	560
5	3/28/01 19:53	13	11.00	210	590
5	3/28/01 20:45	11	8.20	180	560
5	3/28/01 21:38	10	7.90	180	570
5	3/28/01 21:38	10	8.00	180	560
5	3/28/01 23:25	13	7.80	170	530
5	3/29/01 0:22	10	5.00	130	480
5	3/29/01 1:20	10	4.30	110	430
5	3/29/01 2:19	9	3.90	110	420
5	3/29/01 3:17	10	3.60	98	390
5	3/29/01 5:16	10	2.70	91	370
5	3/29/01 6:17	10	2.80	83	370
5	3/29/01 7:18	11	2.10	73	340
5	3/29/01 8:18	10	1.80	72	330
5	3/29/01 9:18	10	1.50	64	310
5	3/29/01 9:18	11	1.60	67	310
5	3/29/01 11:21	11	1.40	62	300
5	3/29/01 12:26	12	1.40	67	330
5	4/2/01 10:17	12	1.30	58	240
5	4/2/01 13:14	12	1.60	55	210
5	4/2/01 15:47	11	1.40	54	190

Dry Dock	Logged Date	TSS (mg/L)	Turbidity (NTU)	Copper (ppb)	Zinc (ppb)
5	4/2/01 19:35	13	1.70	51	190
5	4/2/01 23:16	12	1.40	48	200
5	4/3/01 1:37	13	1.00	44	200
5	4/3/01 3:54	17	1.00	45	270
5	4/3/01 6:33	19	0.95	46	270
5	4/3/01 9:18	19	0.93	46	260
5	4/3/01 9:18	16	0.96	48	260
5	4/3/01 12:59	12	0.60	48	220
5	4/3/01 12:59	8	0.70	50	220
5	4/3/01 16:56	13	1.50	79	280
5	4/3/01 22:39	15	1.50	95	350
5	4/4/01 4:08	19	1.40	88	370
5	4/4/01 8:22	20	0.80	84	370
5	4/4/01 14:00	15	1.10	75	340
5	4/4/01 19:45	18	1.20	71	320
5	4/5/01 1:23	18	0.90	65	320
5	4/5/01 5:14	16	0.80	60	300
5	4/5/01 11:01	14	0.90	57	290
5	4/5/01 11:01	7	1.10	57	290
5	4/10/01 11:39	23	1.10	71	340
5	4/10/01 12:36	22	1.10	66	310
5	4/10/01 13:03	21	2.40	81	310
5	4/10/01 13:22	18	7.20	160	460
5	4/10/01 13:36	17	11.00	200	540
5	4/10/01 13:49	13	35.00	500	890
5	4/10/01 14:02	15	24.00	500	970
5	4/10/01 14:15	16	21.00	490	870
5	4/10/01 14:28	21	27.00	600	980
5	4/10/01 14:42	20	31.00	550	920
5	4/10/01 14:56	16	26.00	490	880
5	4/10/01 15:11	16	21.00	470	850
5	4/10/01 15:27	15	24.00	540	890
5	4/10/01 15:44	10	19.00	450	800
5	4/10/01 16:18	15	25.00	520	890
5	4/10/01 16:37	12	22.00	420	780
5	4/10/01 16:56	10	20.00	410	800
5	4/10/01 17:16	9	15.00	390	750
5	4/10/01 17:36	10	19.00	410	780
5	4/10/01 17:57	8	19.00	320	660
5	4/10/01 18:18	8	18.00	310	650
5	4/10/01 18:39	8	16.00	280	610
5	4/10/01 19:03	9	14.00	310	680
5	4/10/01 19:03	8	15.00	320	680
5	4/10/01 19:58	10	13.00	260	630
5	4/10/01 19:58	9	13.00	280	610
5	4/11/01 13:14	19	4.40	130	430
5	4/11/01 13:19	21	2.80	120	430
5	4/11/01 13:29	19	3.10	110	480
5	4/11/01 14:29	18	2.00	100	520
5	4/11/01 15:23	17	2.60	100	510
5	4/11/01 16:24	12	1.90	95	430
5	4/11/01 16:24	14	2.00	94	440
5	4/11/01 17:26	14	1.40	88	380
5	4/11/01 18:27	20	1.60	80	350
5	4/11/01 20:27	14	1.50	77	320
5	4/11/01 21:27	13	1.50	68	300
5	4/16/01 11:29	8	1.10	38	170
5	4/16/01 12:27	10	1.20	39	190
5	4/16/01 14:27	10	1.50	47	210
5	4/16/01 15:27	12	1.60	46	190
5	4/16/01 16:29	11	2.00	48	200
5	4/16/01 17:32	10	2.10	38	220
5	4/16/01 18:36	14	2.20	43	180
5	4/16/01 20:41	11	1.50	41	180
5	4/16/01 21:42	12	1.50	37	180
5	4/16/01 22:33	12	1.50	37	160

Dry Dock	Logged Date	TSS (mg/L)	Turbidity (NTU)	Copper (ppb)	Zinc (ppb)
5	4/16/01 22:46	12	3.00	88	250
5	4/16/01 22:55	14	11.00	240	520
5	4/16/01 23:03	24	17.00	560	910
5	4/16/01 23:08	31	35.00	780	1200
5	4/16/01 23:16	31	41.00	810	1200
5	4/16/01 23:29	21	23.00	600	980
5	4/16/01 23:36	24	28.00	780	1200
5	4/16/01 23:43	19	33.00	670	1000
5	4/16/01 23:49	25	29.00	690	1100
5	4/17/01 0:09	23	28.00	920	1200
5	4/17/01 0:18	31	36.00	720	1000
5	4/17/01 11:39	8	14.00	220	510
5	4/17/01 11:57	15	20.00	340	650
5	4/17/01 12:15	15	24.00	400	730
5	4/17/01 12:38	14	25.00	380	700
5	4/17/01 13:06	11	22.00	360	670
5	4/17/01 14:06	14	20.00	340	630
5	4/17/01 14:06	13	20.00	360	680
5	4/17/01 14:45	10	20.00	280	500
5	4/17/01 14:45	11	21.00	350	640
5	4/17/01 15:31	9	19.00	300	580
5	4/17/01 16:13	9	17.00	280	530
5	4/17/01 16:20	17	23.00	420	600
5	4/17/01 16:26	37	59.00	1200	1300
5	4/17/01 16:35	66	70.00	1100	1200
5	4/17/01 16:43	61	78.00	1600	1800
5	4/17/01 16:44	65	81.00	1800	2000
5	4/17/01 16:51	58	90.00	1400	1500
5	4/17/01 17:00	51	89.00	1500	1600
5	4/17/01 17:08	47	82.00	1500	1600
5	4/17/01 17:16	40	71.00	1200	1300
5	4/17/01 17:25	35	75.00	1200	1300
5	4/17/01 17:33	33	62.00	920	1000
5	4/17/01 17:41	29	60.00	1200	1300
5	4/17/01 17:50	29	61.00	790	900
5	4/17/01 18:33	32	57.00	860	960
5	4/17/01 19:01	21	33.00	700	880
5	4/18/01 15:00	9	6.80	180	430
5	4/18/01 16:02	8	8.00	160	390
5	4/18/01 18:07	10	6.40	140	340
5	4/18/01 19:11	10	6.40	160	410
5	4/18/01 20:17	10	5.10	130	340
5	4/18/01 21:22	11	4.50	98	270
5	4/18/01 23:28	10	3.50	78	240
5	4/19/01 0:31	11	2.60	100	300
5	4/19/01 1:34	11	2.50	69	200
5	4/19/01 2:36	9	1.70	81	270
5	4/19/01 3:37	11	1.80	95	310
5	4/19/01 5:39	10	1.30	82	290
5	4/19/01 6:41	11	1.30	82	290
5	4/19/01 7:45	11	1.00	78	300
5	4/19/01 7:45	11	1.20	88	280
5	4/19/01 8:48	13	1.00	60	250
5	4/19/01 8:48	12	1.10	69	260
5	4/23/01 9:29	12	3.30	110	410
5	4/23/01 9:29	13	3.40	100	370
5	4/23/01 11:00	13	3.40	100	400
5	4/23/01 11:00	13	3.50	110	390
5	4/23/01 11:49	12	3.30	100	380
5	4/23/01 12:38	13	2.20	100	380
5	4/23/01 13:26	10	2.60	100	350
5	4/23/01 14:15	9	2.40	78	300
5	4/23/01 15:48	9	2.20	76	270
5	4/23/01 16:36	9	2.40	85	300
5	4/23/01 17:24	8	2.00	63	250
5	4/23/01 18:11	9	1.60	73	250

Dry Dock	Logged Date	TSS (mg/L)	Turbidity (NTU)	Copper (ppb)	Zinc (ppb)
5	4/23/01 18:56	8	1.50	76	270
5	4/23/01 20:07	10	1.90	62	190
5	4/23/01 20:48	9	2.20	75	220
5	4/23/01 21:32	8	2.30	87	270
5	4/23/01 22:17	9	2.20	88	290
5	4/23/01 23:03	8	2.00	90	350
5	4/24/01 0:36	10	1.90	79	260
5	4/24/01 1:23	8	1.70	78	270
5	4/24/01 2:11	10	1.80	81	290
5	4/24/01 2:58	11	1.90	78	250
5	4/24/01 4:28	8	1.80	69	240
5	4/24/01 5:14	8	2.00	60	220
5	4/24/01 5:53	9	1.70	63	240
5	4/24/01 6:25	9	1.30	64	240
5	4/24/01 13:34	9	1.00	66	260
5	4/24/01 14:25	11	1.10	67	250
5	4/24/01 15:14	9	0.98	71	220
5	4/24/01 16:02	10	1.20	71	220
5	4/24/01 16:50	10	1.30	65	190
5	4/24/01 16:51	10	1.20	62	190
5	4/24/01 18:22	17	1.20	59	180
5	4/24/01 19:07	10	1.10	55	170
5	4/24/01 19:42	10	1.00	55	180
5	4/24/01 20:15	11	0.97	58	200
5	4/24/01 21:28	10	0.88	46	190
5	4/24/01 22:13	13	0.76	40	180
5	4/24/01 22:59	12	0.71	45	200
5	4/24/01 23:46	9	0.73	49	220
5	4/25/01 0:33	9	0.77	44	190
5	4/25/01 2:04	9	0.67	45	210
5	4/25/01 2:51	10	0.66	40	180
5	4/25/01 3:37	10	0.54	50	220
5	4/25/01 4:23	10	0.51	51	210
5	4/25/01 5:09	8	0.48	51	180
5	4/25/01 5:55	9	0.52	44	200
5	4/25/01 7:02	9	0.55	44	200
5	4/25/01 7:33	11	0.57	41	170
5	4/25/01 7:33	10	0.60	44	200
5	4/25/01 8:08	13	0.73	48	250
5	4/25/01 8:08	13	0.77	44	240
5	4/25/01 12:00	14	2.20	67	220
5	4/25/01 12:50	13	2.00	53	180
5	4/25/01 13:39	11	2.00	54	170
5	4/25/01 14:29	12	1.90	58	170
5	4/25/01 16:06	11	2.00	55	170
5	4/25/01 16:55	12	1.90	68	200
5	4/25/01 17:44	11	1.60	50	140
5	4/25/01 17:44	10	1.60	50	150
5	4/25/01 18:32	11	1.70	51	150
5	4/25/01 19:20	7	1.40	45	140
5	4/25/01 20:28	10	1.60	53	170
5	4/25/01 20:58	10	1.20	65	190
5	4/25/01 20:59	9	1.30	41	140
5	4/25/01 21:27	12	1.30	43	170
5	4/25/01 21:55	12	1.20	46	200
5	4/25/01 21:55	10	1.30	54	200
5	4/25/01 22:25	11	1.20	59	260
5	4/25/01 23:32	10	0.83	47	250
5	4/26/01 0:08	13	0.85	39	210
5	4/26/01 0:44	10	0.62	35	210
5	4/26/01 1:21	10	0.65	39	230
5	4/26/01 1:57	9	0.59	39	190
5	4/26/01 3:08	8	0.65	40	220
5	4/26/01 3:08	8	0.68	39	200
5	4/26/01 3:44	7	0.57	35	200
5	4/26/01 3:44	9	0.60	41	220

Dry Dock	Logged Date	TSS (mg/L)	Turbidity (NTU)	Copper (ppb)	Zinc (ppb)
5	4/30/01 8:22	8	12.00	280	720
5	4/30/01 8:31	6	13.00	250	680
5	4/30/01 8:39	7	13.00	280	710
5	4/30/01 8:46	6	12.00	320	800
5	4/30/01 8:52	7	14.00	360	880
5	4/30/01 8:56	8	14.00	340	780
5	4/30/01 8:59	10	13.00	250	640
5	4/30/01 9:04	13	18.00	280	600
5	4/30/01 9:09	14	12.00	360	710
5	4/30/01 9:13	14	20.00	430	860
5	4/30/01 9:18	13	21.00	430	850
5	4/30/01 9:24	15	23.00	460	840
5	4/30/01 9:28	14	24.00	450	790
5	4/30/01 9:33	15	22.00	540	930
5	4/30/01 9:38	15	28.00	490	840
5	4/30/01 9:42	16	25.00	540	910
5	4/30/01 9:47	16	25.00	500	850
5	4/30/01 9:49	15	26.00	510	850
5	4/30/01 9:57	14	25.00	460	810
5	4/30/01 10:02	16	23.00	540	1100
5	4/30/01 10:03	16	33.00	620	1000
5	4/30/01 10:06	17	27.00	610	980
5	4/30/01 10:16	15	22.00	520	880
5	4/30/01 10:16	14	23.00	490	820
5	4/30/01 10:20	18	23.00	610	1000
5	4/30/01 10:20	15	26.00	530	890
5	5/1/01 12:56	7	1.70	47	170
5	5/1/01 12:56	7	1.80	39	160
5	5/1/01 14:26	6	1.50	44	150
5	5/1/01 14:26	7	1.50	46	160
5	5/1/01 15:05	22	1.40	62	160
5	5/1/01 15:45	7	7.00	68	190
5	5/1/01 16:28	7	3.20	79	190
5	5/1/01 17:13	9	2.50	78	190
5	5/1/01 17:59	9	2.50	73	180
5	5/1/01 18:00	8	3.00	82	190
5	5/1/01 19:31	9	2.40	75	170
5	5/1/01 20:18	8	1.80	72	170
5	5/1/01 21:05	8	1.80	66	160
5	5/1/01 21:51	7	1.70	59	170
5	5/1/01 22:37	8	1.90	53	140
5	5/2/01 0:06	8	1.10	56	170
5	5/2/01 0:52	9	1.00	63	190
5	5/2/01 1:37	8	2.50	46	170
5	5/2/01 2:22	10	1.20	38	150
5	5/2/01 3:00	8	1.20	49	150
5	5/2/01 4:10	10	1.30	51	160
5	5/2/01 4:52	10	1.20	64	200
5	5/2/01 5:35	11	1.30	41	210
5	5/2/01 6:21	11	1.50	40	190
5	5/2/01 7:06	11	1.10	43	200
5	5/2/01 7:52	9	1.30	33	190
5	5/2/01 10:51	9	1.00	42	200
5	5/2/01 10:51	10	1.20	36	180
5	5/2/01 11:37	9	1.30	34	160
5	5/2/01 11:37	8	1.30	40	180
5	5/2/01 12:23	9	1.30	39	160
5	5/2/01 13:53	10	2.90	48	240
5	5/2/01 14:36	9	2.50	45	200
5	5/2/01 15:22	8	2.30	42	180
5	5/2/01 16:08	8	2.30	44	170
5	5/2/01 16:55	9	2.80	40	170
5	5/2/01 18:27	9	2.20	45	170
5	5/2/01 19:15	8	2.00	41	150
5	5/2/01 20:03	9	1.90	53	160
5	5/2/01 20:51	8	1.80	42	150

Dry Dock	Logged Date	TSS (mg/L)	Turbidity (NTU)	Copper (ppb)	Zinc (ppb)
5	5/2/01 20:52	8	1.80	37	130
5	5/2/01 21:38	6	1.30	37	140
5	5/2/01 23:10	7	1.70	38	150
5	5/2/01 23:56	6	2.10	35	140
5	5/3/01 0:42	5	1.40	44	150
5	5/3/01 1:28	9	2.10	36	140
5	5/3/01 2:13	8	2.20	46	160
5	5/3/01 2:58	8	2.00	42	150
5	5/3/01 4:16	6	1.40	48	180
5	5/3/01 4:54	8	1.30	52	190
5	5/3/01 5:36	10	1.40	44	170
5	5/3/01 6:20	10	1.20	56	210
5	5/7/01 10:42	8	1.00	51	130
5	5/7/01 11:29	8	0.85	51	140
5	5/7/01 11:29	8	1.10	50	130
5	5/7/01 13:02	8	1.40	45	120
5	5/7/01 13:56	7	1.90	46	120
5	5/7/01 15:01	6	1.20	40	120
5	5/7/01 16:07	9	1.60	44	120
5	5/7/01 17:13	11	2.00	51	160
5	5/7/01 18:18	12	1.60	52	170
5	5/7/01 18:18	12	1.70	42	120
5	5/7/01 20:24	10	1.90	56	170
5	5/7/01 21:30	10	1.50	62	200
5	5/7/01 22:36	9	1.30	49	160
5	5/7/01 23:44	11	1.40	51	180
5	5/8/01 0:50	11	1.20	55	220
5	5/8/01 3:00	9	1.80	60	230
5	5/8/01 4:04	12	1.30	48	200
5	5/8/01 5:07	12	1.30	50	99
5	5/8/01 6:10	13	1.40	50	200
5	5/8/01 7:13	9	1.10	61	220
5	5/8/01 8:16	11	1.10	51	190
5	5/8/01 8:16	12	1.20		220
5	5/8/01 10:26	12	1.30	61	220
5	5/8/01 10:26	14	1.40	57	220
5	5/8/01 11:33	11	1.10	61	210
5	5/8/01 12:42	11	1.50	58	230
5	5/8/01 13:51	10	1.80	48	200
5	5/8/01 14:56	9	1.50	48	190
5	5/8/01 16:58	10	1.70	66	220
5	5/8/01 17:57	9	2.00	54	190
5	5/8/01 18:59	10	2.90	63	210
5	5/8/01 20:01	11	2.00	50	180
5	5/8/01 21:02	11	2.00	55	190
5	5/8/01 22:05	10	1.80	55	200
5	5/9/01 0:10	11	2.40	53	170
5	5/9/01 1:13	11	2.30	48	170
5	5/9/01 2:16	10	2.00	55	180
5	5/9/01 2:16	12	2.10	48	160
5	5/9/01 3:17	11	1.60	52	190
5	5/9/01 4:18	11	1.50	44	160
5	5/9/01 5:19	10	1.40	51	200
5	5/9/01 7:18	12	1.20	48	200
5	5/9/01 8:19	12	0.98	49	190
5	5/9/01 8:19	11	1.00	48	180
5	5/9/01 9:21	11	0.90	43	170
5	5/9/01 9:21	12	1.40	49	200
5	5/9/01 10:24	10	1.30	40	54
5	5/9/01 11:24	11	2.20	40	41
5	5/9/01 13:26	13	2.00	46	190
5	5/9/01 14:35	12	2.20	38	170
5	5/9/01 14:36	11	1.90	46	150
5	5/9/01 15:44	13	2.10	46	150
5	5/9/01 16:50	12	2.00	43	140
5	5/9/01 17:54	11	2.30	53	170

Dry Dock	Logged Date	TSS (mg/L)	Turbidity (NTU)	Copper (ppb)	Zinc (ppb)
5	5/9/01 18:58	12	2.70	58	180
5	5/9/01 21:03	14	2.80	69	200
5	5/9/01 22:04	13	2.50	58	180
5	5/9/01 23:05	14	2.80	52	180
5	5/10/01 0:09	14	2.00	51	180
5	5/10/01 0:09	13	2.20	51	180
5	5/10/01 1:13	13	1.90	46	160
5	5/10/01 3:19	9	1.40	45	180
5	5/10/01 4:23	13	1.50	45	170
5	5/10/01 4:24	14	1.50	37	150
5	5/10/01 5:26	16	1.90	42	170
5	5/10/01 6:29	14	1.40	44	160
5	5/10/01 7:31	14	1.70	44	170
5	5/10/01 9:34	11	1.80	50	180
5	5/10/01 10:37	10	1.30	38	150
5	5/10/01 10:37	12	1.70	43	170
5	5/10/01 11:42	13	1.70	40	160
5	5/10/01 11:42	12	1.80	43	180

PSNS & IMF Changes/Improvements to meet water quality compliance:

PSNS & IMF instituted changes to dry dock storm water run-off operations in order to meet compliance regulations. The actions taken by PSNS & IMF resulted in an average **85% reduction** in copper loading (lb/day) to the Sinclair inlet when compared to the previous eight months for the largest discharge, Out Fall 19. Below is a summary of the changes PSNS & IMF have instituted.

1. Process Water Control System:
   - Modified the dry-dock floor drainage channels in dry-docks 2 and 5, purchased new pumps.
   - Upgraded and Repaired Sanitary Sewer System:
     - Upgraded sanitary lift-station #3
     - Repaired the sanitary sewer force-main blockage
   - Increased Diversion Capacity

2. Source Control:
   - PSNS&IMF now requires Full Filtered Containment for high copper producing evolutions such as spray painting or blasting of anti-fouling paints.

   (Copper anti-fouling paints can be applied without full containment if it is directly applied with brushes or rollers)

3. Additional Cleaning:
   - Implemented New Dry-dock cleaning standards.

Quantifiable Results in Water Quality After Changes/Improvements:

Average Monthly Copper Loading (lb's/day) to Sinclair Inlet

Out Fall 19

Before BMP's Implemented		After BMP's Implemented	
-	lb's/day of Cu	-	lb's/day of Cu
Dec-07	0.37	Aug-08	0.18
Jan-08	3.57	Sep-08	0.34
Feb-08	0.11	Oct-08	0.00
Mar-08	0.00	Nov-08	0.00
Apr-08	0.22	Dec-08	0.10
May-08	0.00	Jan-09	0.00
Jun-08	0.23	Feb-09	0.11
Jul-08	0.77	Mar-09	0.10
Average Loading (lb's/day) over 8 months:	**0.66**		**0.10**

Average Monthly Copper Loading (lb's/day) to Sinclair Inlet

Out Fall 18A/B

Before BMP's Implemented		After BMP's Implemented	
	lb's/day of Cu		lb's/day of Cu
Dec-07	0.42	Aug-08	0.33
Jan-08	0.24	Sep-08	0.20
Feb-08	0.61	Oct-08	0.08
Mar-08	0.00	Nov-08	0.11
Apr-08	0.00	Dec-08	0.00
May-08	0.00	Jan-09	0.13
Jun-08	0.52	Feb-09	0.41
Jul-08	0.46	Mar-09	0.03
Average Loading (lb's/day) over 8 months:	**0.28**		**0.16**
Total Average (lb's/day) over 8 months:	**0.94**		**0.26**

*** 72% Reduction** in average Copper loading over the past 8 months from OF 18, 18a and 19 since implementation of new BMP's.

Monetary Costs of Changes/Improvements:

Fixed One-Time Costs:

Improved Process Water Control System:	
Modified the dry-dock floor drainage channels in dry-docks 2 and 5, new pumps	$91,000.00
Sewer System Upgrades and Repairs. (1) Upgraded sanitary lift-station #3 (2) Repaired the sanitary sewer force-main blockage	$216,901.00 *

Total Fixed One-Time Costs Incurred: $ 307,901.00*

* An additional $2,474,731.00 was spent on repairing the sanitary sewer force-main blockage, however this cost would have been incurred in absence of the failure of compliance notification.

Yearly Operational Costs:

Improved Process Water Control System:	
Increased Diversion Capacity	$6,000.00
Improved Source Control:	
Full Containment and rolling copper based anti-fouling paint for a Trident Submarine. (Containment costs for Air	$558,000.00

Craft Carriers will be substantially higher.)	
Additional Cleaning:	
Dry-dock cleaning	$520,000.00

Total Yearly Operational Costs for Compliance: $1,084,000.00

"Tran, Jeanne (ECY)" <JTRA461@ECY.WA.GOV>
05/15/2009 10:03 AM

To Susan Poulsom/R10/USEPA/US@EPA
cc
bcc
Subject FW: Response to Navy's email

Hi Susan, I've drafted up a response to the Navy's email. I think a lot of the information I'm requesting is available (may be is already in the draft AKART, or may be you have those information). Could you take a quick look at the response below and tell me whether my request is reasonable and whether the Navy can provide those information for me? I would like to hear back from you before I send it to G. Sherrell.

Thanks, Jeanne

Gerry,
Thanks for summarizing the actions that the Navy has taken to achieve copper reduction. After reviewing the information, I have the following questions, which I seek answers to, in order to estimate the level of copper reduction is achieved as a result of the recently implemented BMPs. Please send me the following information.

1) The number of each type of vessel the Navy conducted bottom painting using copper anti-fouling paint during the period between December 2007 and July 2008 for dry docks associated with outfall 19 and outfall 18A/B. The number of each type of vessel the Navy conducted bottom painting using copper anti-fouling paint during the period between August 2008 and March 2009 for dry docks associated with outfall 19, and outfall 18A/B. A total of 4 pieces of information.
2) Flow data for each of the following: non-contact cooling water, groundwater infiltration, and dry dock floor drainage discharge for outfall 19 and 18A/B to Sinclair Inlet during the period between December 2007 and March 2009.
3) The number of days in a year that the dry dock floor drainage is discharged to Sinclair Inlet for outfall 19 and 18A/B?
4) The averaged copper concentration in groundwater that is being discharged to the Inlet through the dry dock drainage system. Please provide the seasonal data if it is possible.
5) A detailed description of how the spray paint operation is enclosed (e.g. location of tarps).

The level of copper reduction achieved by the Navy will be compared to the level of reduction achieved by Nichols Brothers. Please understand that I do not view the effort the Navy has put in to improve the operation of the dry docks as a whole, and the quality of the discharge, as an insignificant achievement. I also need to be equally fair to the other shipyards and hold the Navy to achieve the same level of reduction.
If you have any questions, please do not hesitate to contact me.

Thanks, Jeanne

From: Sherrell, Gerald M CIV Code 106.3, Code 106.32 [mailto:gerald.sherrell@navy.mil]

Sent: Wed 5/13/2009 9:03 AM
To: Tran, Jeanne (ECY); Poulsom.Susan@epamail.epa.gov
Cc: Beckwith, Bruce CIV Code 106.3, Code 106.32; Harrison, Eric J CIV PSNS, 106.32; Rupp, Steven S CIV Code 106.3, Code 106.3
Subject:

Jeanne,

I wanted to follow up our last phone conversation by sending you this summary of actions, the results of those actions and the cost of the actions that PSNS&IMF has taken to reduce the level of pollutants entering storm water runoff from dry dock floors.

We believe that these action have minimized the concentration of pollutants entering storm water runoff from the dry dock floors to the maximum extent possible short of the military construction project that we have discussed previously.

There was obviously some frustration on both sides of the table so I hope that this helps resolve it to some extent. I would also like to extend an invitation to you and Susan to come over an take a look at a hull blast and paint containment that has recently been completed in dry dock 6. I think this may help clear up some misconceptions about that process as well.

If I can provide you with anything else please let me know.

GMSherrell

360-476-8440 summary of actions results costsrev2.doc

Michael Lidgard/R10/USEPA/US
08/06/2008 07:27 AM

To Susan Poulsom/R10/USEPA/US@EPA
cc
bcc
Subject Re: preliminary comments on PSNS draft AKART Study

here you go (advantage to not being efficient with email is I don't delete much) - ml
Susan Poulsom/R10/USEPA/US

Susan Poulsom/R10/USEPA/US
07/28/2008 05:13 PM

To JTRA461@ECY.WA.GOV
cc Michael Lidgard/R10/USEPA/US@EPA
Subject preliminary comments on PSNS draft AKART Study

Jeanne -

Here are some preliminary comments/questions on the PSNS draft AKART study for your consideration. This is not an exhaustive list, and my comments are abbreviated.

1. Their AKART analysis is primarily a comparison of what six other shipyards are doing. Seems like a cursory approach. Why these six shipyards?
2. Dry Dock Floor Drainage - An important issue for the draft permit is collection of the water that comes into contact with the dry dock floor (storm water, wash water, freeze protection water, etc.). All of the water that comes into contact with the dry dock floor is acting as wash water. The Navy makes the statement on page 58 that large shipyards do not collect dry dock or yard stormwater for treatment and/or storage. Is that the extent of the analysis?

Consider that other shipyards collect all storm water/floor drainage. In addition, the working draft permit requires that the Navy to investigate treatment of the dry dock floor drainage.

3. AKART and BMPs - There is a relationship between AKART and the BMPs in the working draft permit. The BMPs in the permit will constitute BAT/BCT/BPT. Under the preliminary draft permit, section II.C list controls which constitute BAT/BCT/BPT. Concern is that some of the AKART BMPs are less stringent than the BMPs in the permit. How do the BMPs in the AKART analysis compare to those in the working draft permit?

4. Areas in the Non-Dock Stormwater AKART Screening page 63 - How did they identify the areas to address?
Part I.E 2.b in the preliminary draft permit requires that the permittee identify all areas at PSNS/IMF for which the Navy believes that despite implementation of BMPs, the stormwater will exceed Washington WQS. How do the areas in the AKART compare to that criteria?
Table 13 of the Fact Sheet identifies stormwater areas of concern for EPA, did the Navy

consider these areas in the AKART areas screening?

5. Pollutants of Concern
Page 15. "Tributlytin is not used at the PSNS & IMF" What does the Navy mean by used? Is tributlytin ever part of a decommissioned vessel that is being cut up?

Page 16. What is the basis for needing to show up twice on Table 6-1 to be a pollutant of concern? What about detected concentrations in the stormwater or dry dock drainage? What about looking at permit limits in the draft permit that the Navy cannot currently meet?

What about temperature, chlorine (They add chlorine to ship cooling water.)

6. Treatment
Pg. vi. Describe the OWTS. Does it remove metals? The Navy has asserted that sending flows for treatment/discharge to sanitary does not reduce the metals discharged. Does that mean that the OWTS does not remove metals?

7. Specific BMPs Need comparison to BMPs in draft permit.

8. Prevent Exposure
Pg. v. Outdoor metal work for temporary metal work - AKART BMP requires prevention of exposure to stormwater only if the permittee uses the area for greater than one month. Shouldn't it be part of the daily routine? Need to be covered daily. Also see working draft permit Section II.C.2.a) Prevent Exposure. The permittee must to the extent achievable prevent exposure to stormwater.

9. In-water Work. This section does not appear to meet Ecology's standard In-water requirements. Consider the following:
Page v.
Add: The cleaning of any portion of a vessel's hull below the waterline while the vessel is afloat is prohibited.

Add: Conventional abrasive blasting on the vessel's hull while it is in the water is prohibited.

Add: The following methods of paint and coating applications to a vessel's hull while in the water at an NPDES permitted shipyard are allowed provided that all containment, collection, and spill prevention BMPs are in place before any such applications are made to a vessel's hull.
- Application by roller;
- Application by brush; and
- Conventional spray-paint or spray-coating applications to a vessel's hull while that vessel is in the water are prohibited.

Add??: BMPs for Floats used for In-Water Vessel Maintenance
Floats are defined as free-floating, unattached work platforms capable of moving back and

forth along the length of the ship and around its hull.
Floats shall at all times maintain a minimum of 2" of freeboard at the floats lowest point during all phases of maintenance operations. The minimum 2" freeboard requirement must be maintained with all scaffolding configurations and number of persons on board the float. All necessary precautions will be taken by personnel on board the float to prevent paints, cleaning materials, petroleum products, all other liquids and unsecured materials from entering into the water from the float.

Add: Documentation Requirements for In-Water Vessel Maintenance BMPs???

10. Include concentrations of Pollutants in Dry Dock Floor Drainage. This helps indicate success of BMPs in dry dock.

11. Maximizing Dry Dock Drainage to Treatment/Sanitary Sewer - Need to look at volume of dry dock drainage, maximizing flow to the sanitary sewer/treatment. All of the discharges into the dry dock are acting as wash water. Need to avoid these discharges or send flows for treatment/discharge to sanitary sewer.

12. Selection of Similar Dischargers
Pg. 41. What about Portsmouth and Pearl Harbor

There are 43 yards are capable of dry-docking vessels of 122 meters in length or over.
http://www.globalsecurity.org/military/facility/intro-shipyard.htm

13. Pg. 57. Need to separate this discussion for in-water work. It states that hull crawlers are above AKART. Is that true for in-water work? Compare to the standard BMP for Ecology which is prohibition: "Conventional mechanical grinding or use of other powered mechanical abrading tools; and Conventional abrasive blasting on the vessel's hull while it is in the water is prohibited."

Innovative abrasive blasting systems or ultra-high water pressure systems for surface preparation will be conventional spray-paint or spray-coating applications to a vessel's hull while that vessel is in the water." "Innovative spray-paint or spray-coating application methods will be allowed..."

14. Pg. 58. List of large shipyards. What's the list of large shipyards? Which large shipyards do not collect dry dock drainage water? Which ones treat/do not treat. Did they research this? Study makes this conclusion, but I don't see the data, seems very qualitative.

15. Pg. 60. Where are the analytical results/criteria for what they are calling "dirty"

16. Pg. 62 Metals Removal - Drawing conclusions about metals. Where's the data showing the 10 ppb difference. Can they alter the cooling water to be less aggressive? What about chlorine? Study draws conclusion, but I don't see the analysis.

17. What about new construction. For example, on the piers what happens when they retrofit a pier. Do they require that the areas discharge to a stormwater with filter fabric/treatment?

18. The Navy has stated that it may be weeks before ship cooling water in the dry dock is diverted directly to the outfall to avoid contact with the dry dock floor. Why does that take so long? I don't see any BMPs associated with shortening this time period.

19. Why did the Navy exclude Outfall 021 from the AKART analysis? Can they meet end of pipe temperature limits for the steam generation plant?

20. How do they currently prevent exposure to blasting grit?

DEPARTMENT OF THE NAVY

PUGET SOUND NAVAL SHIPYARD
AND INTERMEDIATE MAINTENANCE FACILITY
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IN REPLY REFER TO
5090
Ser 106.32/0218
JUL 28 2009

Washington State Department of Ecology
NWRO Water Quality Section Head
Mr. Kevin Fitzpatrick
3190 160th Av SE
Bellevue, WA 98008-5452

Dear Mr. Fitzpatrick,

Per Section 401a, Federal Clean Water Act, State Certification of Federal Permits and Licenses, Puget Sound Naval Shipyard and Intermediate Maintenance Facility (PSNS & IMF) is required to complete an All Known, Available, and Reasonable Treatment (AKART) study to be eligible for a mixing zone for outfalls covered under draft permit No. WA-000206-2.

This letter is intended to convey PSNS & IMF's AKART study to Washington State Department of Ecology (WDOE).

In addition, PSNS & IMF would like to directly address comments from the WDOE concerning AKART determination for storm water from dry dock floors. (Attached)

Please direct any question you may have to Mr. Gerald Sherrell at telephone number (360) 476-8440 or Mr. Eric Harrison at telephone number (360) 476-4738.

M. R. Whitney

M. R. WHITNEY
Captain, U. S. Navy
Shipyard Commander

Copy to:
Mike Lidgard, EPA region 10 NPDES Unit Manager
Susan Poulsom, EPA Region 10 NPDES Permit Writer
Jeanne Tran, NWRO Water Quality Engineer

PSNS & IMF'S ALL KNOWN, AVAILABLE, AND REASONABLE (AKART) STUDY

Enclosure (1)

RESPONSE TO COMMENTS FROM WDOE CONCERNING AKART DETERMINATION FOR DRY DOCK STORM WATER

Enclosure (2)

Response to Comments from WDOE Concerning AKART Determination for Dry Dock Storm Water

During recent discussions, Washington Department of Ecology (WDOE) has indicated that they believe that Puget Sound Naval Shipyard and Intermediate Maintenance Facility's (PSNS & IMF)'s source control, and clean up in combination with our partial process water diversion system does not constitute All Known, Available and Reasonable Technology (AKART) because some local boat and shipyards have been able to divert, and in one case collect and treat, storm water from their heavy industrial areas. We would like to address these comments by specifically discussing: 1) Why we believe our current system constitutes AKART, 2) Why consideration of site specific constraints are critical to this determination and, 3) PSNS & IMF's plans to upgrade its current system to what we believe will become AKART and constraints associated with this planning process.

1) AKART determination for current PSNS & IMF system for limiting pollutants in storm water leaving dry dock floors:

The combination of source control, good housekeeping practices, and the PWCS meets or exceeds AKART standard as follows:

- The ability of the Process Water Collection System (PWCS) to detect and divert contaminated stormwater compares favorably with other available treatment systems to manage dry dock stormwater. For comparison, electro-coagulation system data provided in Attachment 10 of the AKART Study and summarized in Table 11-1 shows a higher average copper and zinc effluent concentration, higher 95% concentration and higher maximum concentration than the PWCS.

Table 11-1: Summary of PWCS and Electro-Coagulation Treated Effluent Data

Statistical Descriptor	PWCS	Electro-Coagulation
	Copper (8 NTU set point)	Copper
Average Effluent (µg/l)	43	52
Median Effluent (µg/l)	33	20
95% Effluent (µg/l)	110	168
Max. Effluent (µg/l)	190	666
	Zinc (8 NTU set point)	Zinc
Average Effluent (µg/l)	209	596
Median Effluent (µg/l)	190	175
95% Effluent (µg/l)	478	2458
Max. Effluent (µg/l)	1000	5210

– Set point is 8 NTU, not 25 NTU. How does new trigger affect 96.1 Pty to treat all?

- Since higher concentrations of copper are associated with increased turbidity, the PWCS is capable of achieving 100% "treatment" of the most contaminated stormwater by diverting it to the sanitary sewer. This is not the case for treatment options such as electro-coagulation. For these treatment systems, removal efficiencies vary depending on influent levels and never achieve the effective PWCS efficiency of 100%. Therefore, for treatment options that offer seemly high removal efficiencies of, say 80%, they will still

discharge high levels of contaminates. For example, for an influent of 500 ppb Cu these treatment options will still discharge 100 ppb Cu effluent to the receiving water while the PWCS will have a 0 ppb Cu effluent discharge because 100% of the discharge is sent to the sewer.

- EPA, in 2003 while developing the Metal Products & Machinery Industrial Category Effluent Guidelines[1], indicated that an efficient metals removal treatment system can achieve a copper limit of 280 µg/l. EPA, however, never promulgated the limit since the required cost to achieve it were disproportionate to the associated environmental benefit. The PWCS have an greater effective treatment efficiency when compared to the EPA technology based limit of 280 µg/l.
- The system provides feedback on other Best Management Practices (BMP)s and minimizes the quantity of "clean" stormwater discharged to the sanitary sewer.
- Unlike many shipyards, PSNS & IMF has chosen to separate process water and treat it separately from stormwater. All process water from pressure washing and hydroblasting is collected and treated. In addition, dry abrasive blasting and copper anti-fouling spray paint operations are fully contained to prevent rainwater from contacting overspray and debris. During normal operations only storm, potable, ground, and saltwater-firemain water are collected with the PWCS and routed to Sinclair Inlet or the sanitary sewer. By treating the water with the highest level of contaminates, the total amount of copper discharged to Sinclair Inlet and sanitary sewer are minimized.

Overall, the PWCS falls within the AKART range. The PWCS is unique for large shipyards. They are a reasonable compromise because, while Cascade General Portland Shipyard (Cascade General, Section 9.1), NASSCO (Section 9.4), Norfolk (Section 9.5), and Todd, (Section 9.6) capture and route all of their stormwater and dry dock water to a Publicly Owned Treatment Works (POTW), PSNS & IMF does not have access to a POTW that is capable of accepting this much stormwater, and as described in Section 14 of enclosure (1), installing piping for capturing all of this water and treating it will require Congressional approval of a Military Construction Project and is therefore largely out of the control of this facility. Additionally allowing flooding/ponding of stormwater is not an acceptable option for PSNS & IMF due to the type of work conducted and the structure of the PSNS & IMF graving docks. Another key consideration, in determining AKART, along with the PWCS, is the level of source control in use in the dry docks. The higher the level of source-control, the less stormwater the PWCS will send into the sanitary sewer. The AKART determination is reinforced since; PSNS & IMF practices a high level of source control. The revised BMPs developed in Section 15 of enclosure (1) further enhance source control practices.

2) Site Specific Considerations:

To determine AKART at a specific site, Ecology's Permit Writer's Manual requires the use of best professional judgment when an effluent guideline that is less than five years

[1] Federal Register of May 13, 2003, Metal Products & Machinery Final Rule Promulgation

old does not exist. Section 3.7 of the Ecology Permit Writer's Manual directs that in using best professional judgment:

> *"An AKART determination may take into consideration the treatment performance at a similar manufacturing facility. In this situation the permit writer must assess the costs to the facility to achieve the increased treatment efficiency. Some of the factors to be analyzed are;*
>
> *Are the production processes equivalent?*
>
> *Does this facility have some site specific constraints that would prohibit the increased treatment efficiency?*
>
> *And are the facilities of comparable age?"*

At other boat and shipyards, there are generally two approaches to managing water from dry docks or the industrial work area. Some shipyards are able to collect all water and direct it to a municipal sanitary sewer. PSNS & IMF does not have this option because the Bremerton municipal sanitary sewer cannot handle the volume of water hitting the dry dock floors at PSNS & IMF. The second approach is to collect the water and treat 100% of it with onsite treatment technology. As far as we have been able to determine Nichols Brothers Boat Builders is the only example of successful implementation of this approach. However, a comparison of site specific conditions at PSNS & IMF and Nichols Brothers Boat Builders reveals stark differences between these facilities.

PSNS & IMF is a 170 acre facility with 6 dry docks covering approximately 22 acres. PSNS & IMF has an extremely complex underground infrastructure designed to allow this facility to service the largest and most sophisticated naval vessels in the world. Additionally, the age of this facility (113 years old) means that there are many layers of older infrastructure that further complicates construction projects. By contrast, Nichols Brothers covers approximately 6 acres (about the same area as our largest dry dock), has no dry docks, and works primarily on aluminum hulled commercial vessels.

The installation of piping to collect 100% of the water from the floor of the six dry docks at PSNS & IMF and pump it up and around the docks to treatment units is therefore much more complicated and far more expensive. *Likewise, while collection and treatment may be viable at a very small boat yard that lacks the complex mixture of crane/rail tracks and multiple layers of underground utilities, collection and treatment may not be reasonably transferred to very large complex facilities such as PSNS & IMF.*

The crane rails pose the largest challenge for burying a utility around the dry dock. The crane rails, which surround three sides of each of the six dry docks, bear loads in excess of 2 million pounds. The dry docks were constructed between the 1892 and 1962, and the crane rails and dry docks are in the portion of PSNS & IMF which was created with fill material between the 1890's and the 1940's. To complicate matters further, the docks and rails are in a Comprehensive Environmental Response,

Compensation and Liability (CERCLA) operable unit which is subject to institutional controls. Thus, installing piping under the crane rails and in the vicinity of the docks is a complicated engineering problem and would be extremely expensive. A recent 20 foot extension of a crane rail is costing approximately $750,000, primarily due to the four 70 foot deep pilings which must be installed to support the weight that will be born by the rails. There are miles of crane rail surrounding the docks at PSNS & IMF. Impacts on the structural integrity of the dry docks will also have to be studied. Finally, adjacent to each dry dock and underground, are multi level pump stations containing large pumps and electrical substations that must be worked around. These stations are responsible for pumping groundwater away from the docks to maintain the structural integrity of the docks.

In general, laying pipe with its associated pump capability is not new technology. However, installing piping around the six dry docks at PSNS & IMF may well require the use of new technology and engineering. At the very least, the level of difficulty is nowhere near the simple installation that Nichols Brothers enjoyed. PSNS & IMF awarded a contract for a concept design detailing how the piping could be installed without jeopardizing the structural stability of the six docks, crane rails, and remaining infrastructure. The contractor has yet to recommend a solution. Once one is suggested, it will undergo rigorous review by Navy engineers who must certify the safety of each dry dock and crane rail for maintenance of Navy vessels. Thus the directive in Ecology's Permit Writers' Manual to evaluate site specific constraints, age and differences in production before determining that technology available to one facility is available to another are all highly relevant to the conclusion that just because Nichols Brothers can collect all of the water from their 6 acre industrial area does not mean that to meet AKART PSNS & IMF must do the same.

Aside from whether treatment is known, available or whether site specific constraints limit its utilization, section 3.7 of Chapter IV of the Permit Writer's Manual further requires that cost be considered in an AKART determination.

It is helpful to note that deciding not to set a standard effluent limitation for copper or zinc in its Effluent Limitations Guideline for the Metal Products and Machinery Point Source Category at 40 Code of Federal Regulation (CFR) 438.14, a guideline that specifically includes shipyards, the EPA proposed to implement a monthly average limit of 280 ug/l for copper, based upon "(1) in-process flow control; (2) segregation of wastewater streams; (3) preliminary treatment steps as necessary ...; (4)chemical precipitation using sodium hydroxide; (5) sedimentation using a clarifier; and (6) sludge removal" 68 FR 25686 and 25700, May 13, 2003.

After receiving public comment, the EPA determined that the treatment required to meet even 280 ug/l Cu was too expensive to be deemed achievable and qualify as BAT. As noted in the final rule at 68 FR 25686, 25701, EPA calculated that the effluent reductions expected with the proposal that was rejected cost approximately $1,000/pound pollutant removed in 1981 dollars, "substantially greater than the EPA has typically imposed for BAT technology in other industries (generally less than $200/PE in 1981$)". *Id.*

3) Plans and Constraints to upgrading PSNS & IMF's Process Water Diversion System:

Due to the length of the budgeting cycle for construction of new technology, PSNS & IMF is constantly monitoring and trying to develop or adapt new technology that exceeds performance achieved by our current practices and which will likely be effective at our facilities. PSNS & IMF is several years into the concept study of a proposed project which will:

-Replace existing Oily Water Treatment Systems (OWTS) units with high capacity ones.

-Install piping for connecting the PWCS to the OWTS and tanks.

-Upgrade the sanitary sewer system for added PWCS reliability and capacity.

Between the Appropriation's Clause of the U.S. Constitution and 10 U.S.C. section 2801 *et. seq.*, PSNS & IMF is prohibited from obligating funds for military construction projects (MILCON) exceeding $750,000, until the project is specifically approved by Congress. To obtain that approval PSNS & IMF must complete a concept study and articulate the need for the project through the Department of the Navy, of Defense and then to Congress, which then prioritizes competing needs of the federal government. This process takes approximately three years after completion of concept design. Then, if approved, PSNS & IMF has seven years to complete design, contract award and construction of the project. Given the complexity of the dry docks, any project in that vicinity will likely take all seven years to complete.

At the same time, the Clean Water Act requires the application of Best Available Technology, and the NPDES permit is up for renewal every 5 years. Therefore, PSNS & IMF must plan two permit cycles out. That means that PSNS & IMF is forcing technology so that by the time a project gets installed, PSNS & IMF is still meeting BAT or AKART. The collection and treatment project being designed is an example of technology development that goes beyond the current state of AKART for at least three reasons: (1) Unknown and unavailable treatment technology; (2) site specific challenges to collecting 100% of the water from the floors of the dry docks; and (3) the costs are such that the proposal will exceed the "reasonable" cost criteria utilized by the Environmental Protection Agency (EPA) in setting BAT.

Over the course of the last few years, PSNS & IMF put out a request for bids three times before any manufacturer would bid on the construction of 200 gpm units that would treat copper below 10 ppb. The manufacturer of our 100 gpm unit is the only manufacturer known to be willing to attempt to custom manufacture these 200 gpm treatment plants to this treatment specification. Manufacturers indicated they were not interested in investing in engineering such a unit because there is no demand for units this large elsewhere in the market. Additionally, the treatment performance level of 10 ppb copper far exceeds other methods of treating storm water. The first two units have been delivered to PSNS & IMF and, under controlled testing, have not met all of the treatment levels in the specification, so more work needs to go into refining the units.

Thus, these units are being invented. We do not yet know how they will perform in real world, uncontrolled environment at our dry docks.

Section 3.6 of Chapter IV of the Washington State Department of Ecology Water Quality Program Permit Writer's Manual (Permit Writer's Manual) provides some definition of "known" and "available". Quoting from a Pollution Control Hearing Board opinion, the document states

> *"... SWAPCA may not require an applicant to develop new technology to advance the art of emission control. The "advance" must be "known" in the sense that it has been tested and found to control emissions effectively and efficiently. Under this test SWAPCA may not insist that an emission source be utilized as a proving ground for as yet untried control technology. An applicant must, however, incorporate into its proposal those control systems previously developed and presently available." 88 Wn.2nd at 81, 82."*

While Hydroxide Precipitation technology exists, it has not been utilized with the volume, the scale and at the low copper concentration treatment level PSNS & IMF is trying to develop with the project it is proposing. It has not yet been *"tested and found to control emissions effectively and efficiently."* Id. Therefore, this is neither "known," nor "available". This, however, does not mean that PSNS & IMF will or should stop developing the technology. It, presumably, will become AKART once PSNS & IMF has developed and tested it outside of controlled studies and once we have adapted it after it is installed.

It must also be noted that accepting a permit that mandated the installation of this system would violate federal law. The Antideficiency Act at 31 U.S.C. Section 1341(a)(1) states:

> *"An officer or employee of the United States Government or of the District of Columbia government may not –*
>
> *(B) involve either government in a contract or obligation for the payment of money before an appropriation is made unless authorized by law."*

United States Comptroller General opinions have defined "obligation" to include "a definite commitment that creates a legal liability of the government for the payment of goods and services ordered or received. B-116795, June 18, 1954." B-300480, April 9, 2003 (2003 WL 1857402) The Comptroller General has "extended the definition [of obligation] to include '[a] legal duty on the part of the United States which constitutes a legal liability or which could mature into a legal liability by virtue of actions on the part of the other party beyond the control of the United States.'" **Id.**(citing 42 Comp. Gen. 733, 734 (1963) and McDonnell Douglas Corp. v. United States, 37 Fed. Cl. 295, 301 (1997). "A legal liability is defined, generally, as any duty, obligation or responsibility established by a statute, regulation, or court decision, or where the agency has agreed to assume

responsibility in an interagency agreement, settlement agreement, or similar legally binding document." B-300480, 2003 WL 1857402 (Comp.Gen.).

If the State of Washington or the EPA were to issue a permit which mandated the installation of the untested high volume, low concentration treatment units with the associated difficult piping system, PSNS & IMF would incur a legal liability obligating an unestablished level of funding contrary to 31 U.S.C. 1341(a)(1)(B). If PSNS & IMF accepted the permit without appeal, under the above definition, the permit would be considered a legal liability where PSNS & IMF agreed to assume responsibility in a legally binding document similar to an interagency agreement. This is most clear when it is considered that if Congress did not agree to fund the project, the Clean Water Act authorizes citizen suits which would leave a court no option but to order compliance with the terms of the National Pollutant Discharge Elimination System (NPDES) permit.